The American Journal of Surgery

EDITED BY THURSTON SCOTT WELTON, M.D.

May 1943

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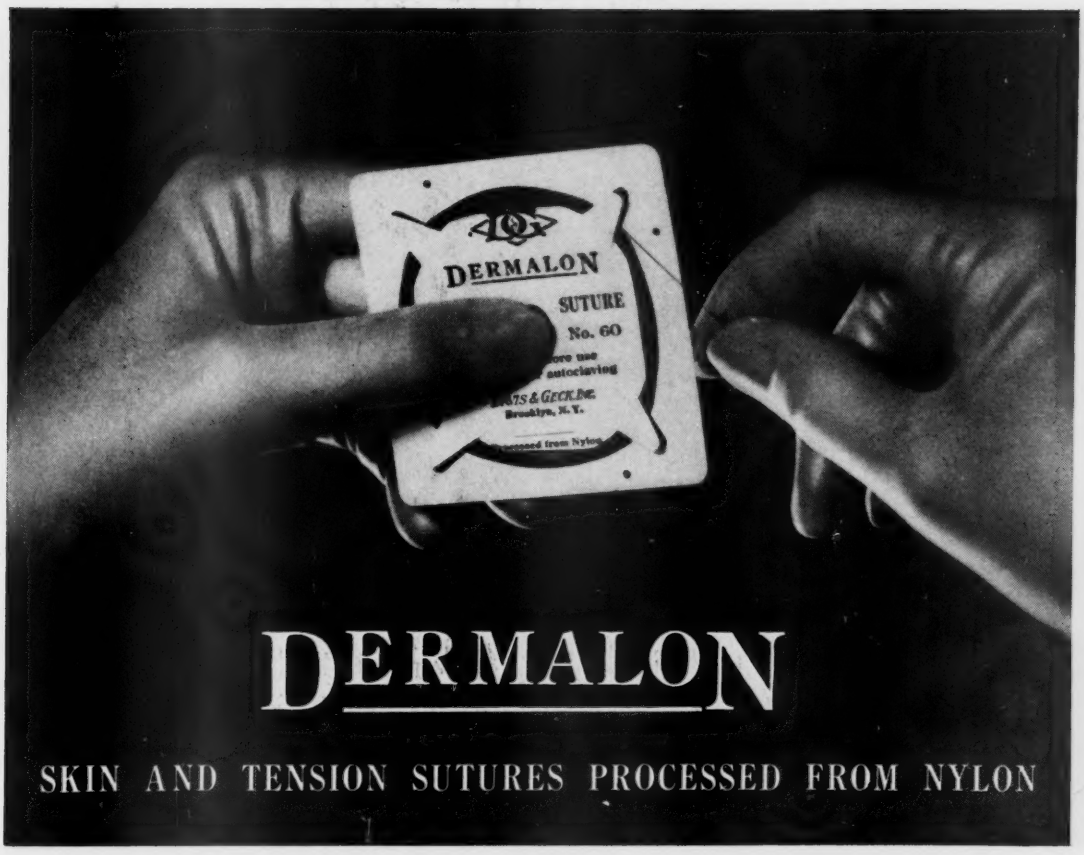

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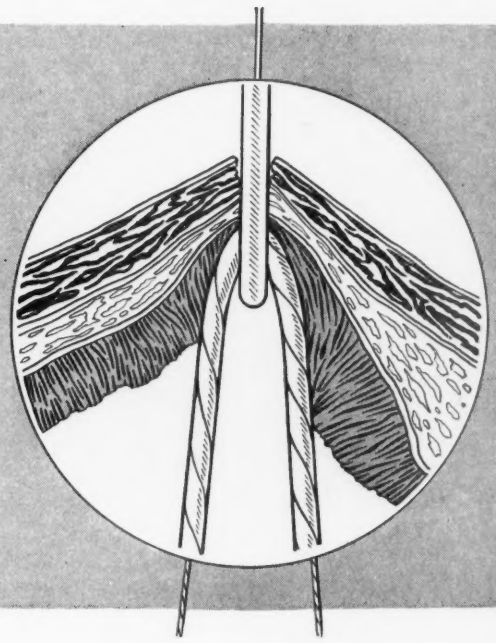

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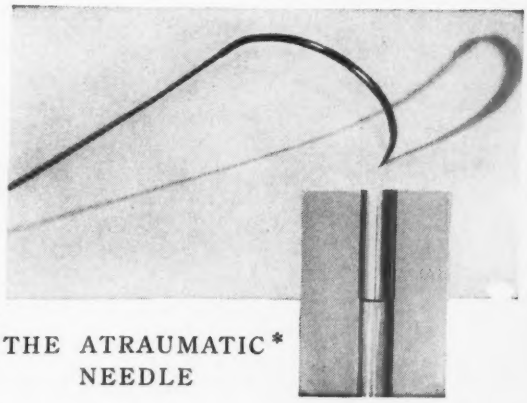

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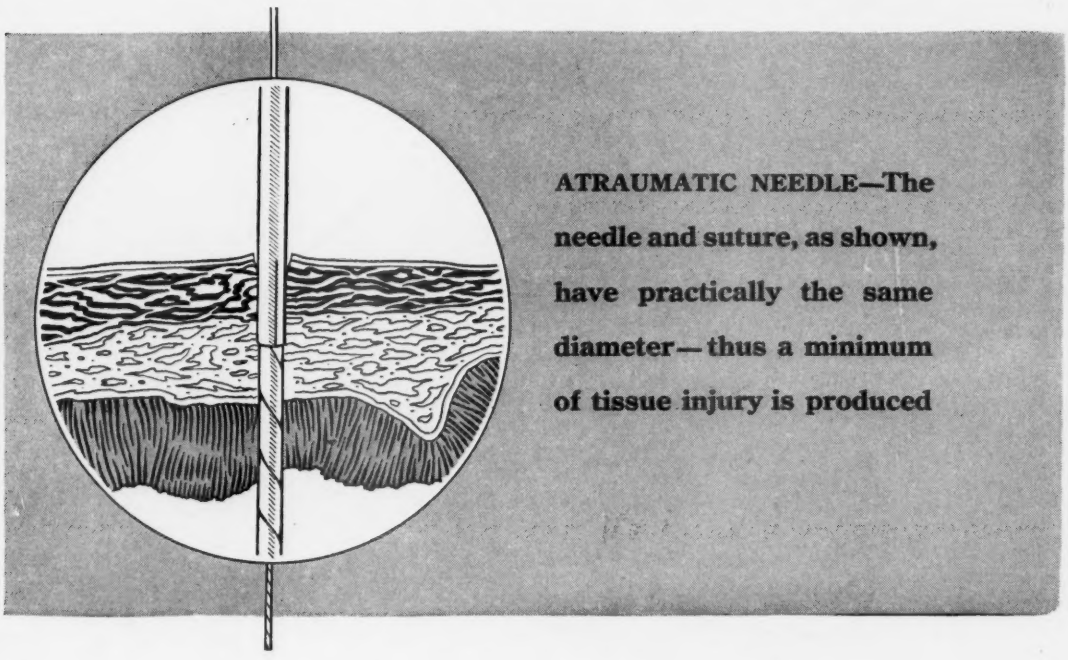

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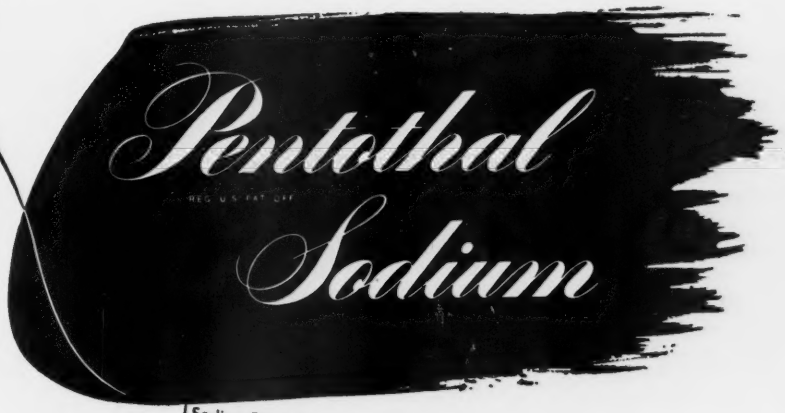

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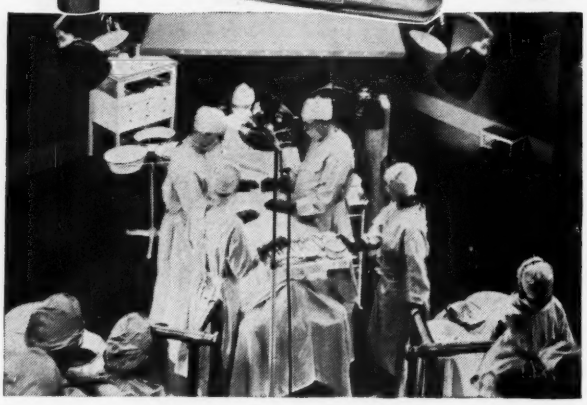

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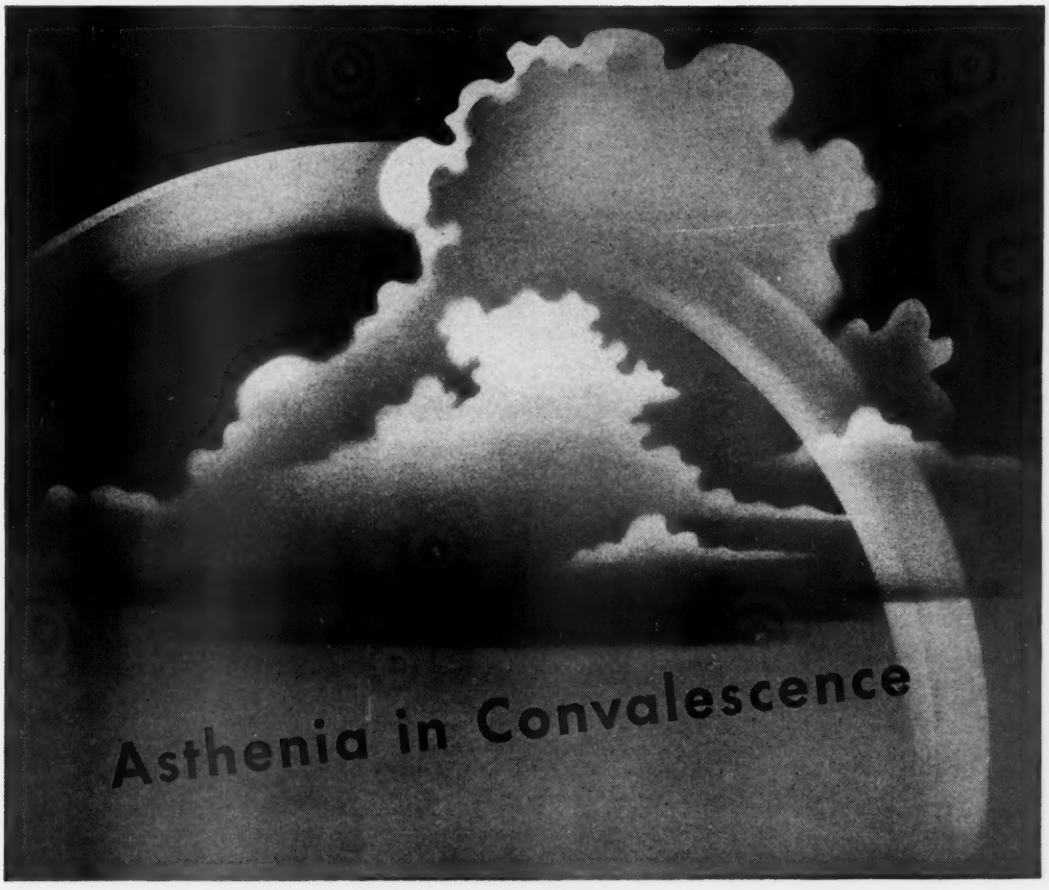

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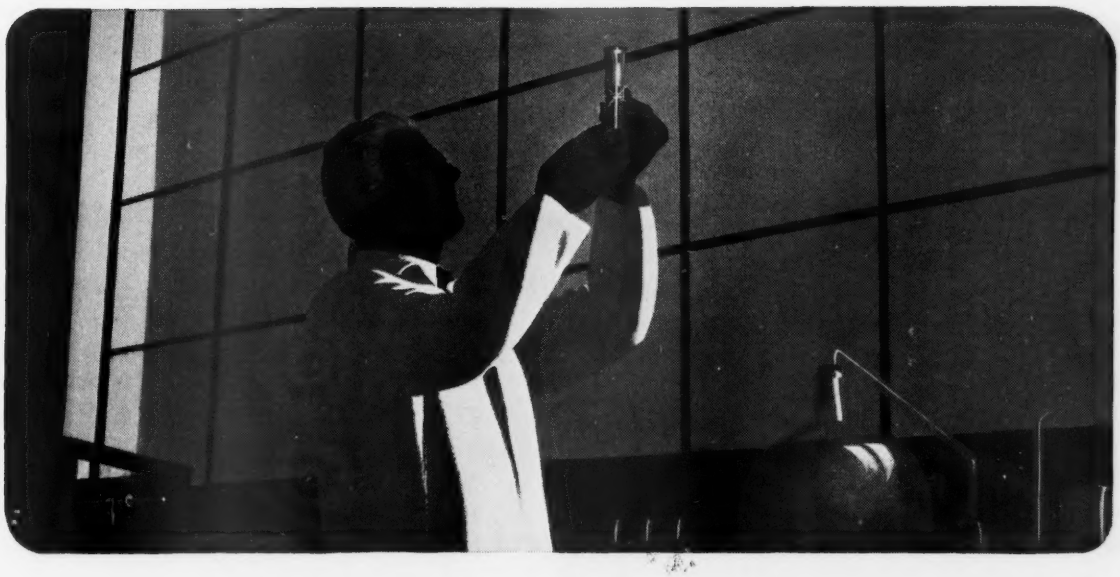

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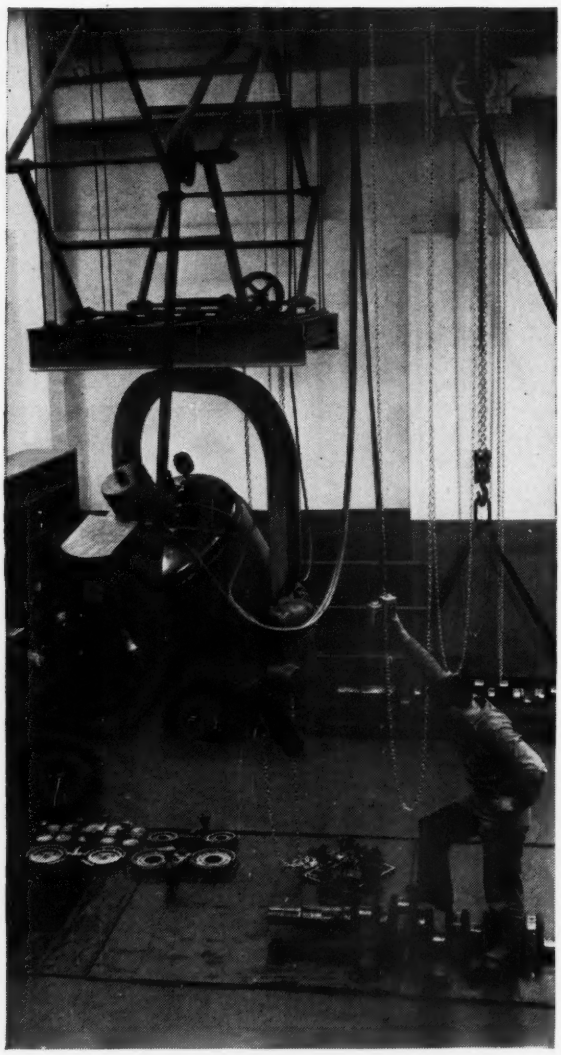


This G-E Million-Volt Unit makes possible the x-ray inspection of critical war materials, including steel castings 8 inches thick.

ARMY E NAVY

GENERAL ELECTRIC X-RAY CORPORATION

2012 JACKSON BLVD. CHICAGO, ILL., U. S. A.

Today's Best Buy – U. S. War Bonds

★ "The use of the Roentgen ray by the Medical Department in the War with Spain has marked a distinct advance in military surgery," wrote the Surgeon General of the U. S. Army in an intensely interesting volume (1899) on this subject. And you know what notable records the x-ray has since written into the annals of military medicine.

But in this World War the x-ray has proved to be equally valuable in its applications to various industrial problems, the solutions of which have not only assured our fighting forces of superior war materials, but also have speeded up the production of these materials.

With specially designed x-ray units war industries are "looking through" metals to determine their fitness for use in ships, tanks, planes, guns, and ammunition . . . X-ray diffraction helps metallurgists to improve processing methods which make critical materials far more serviceable; also facilitates the precisional cutting of quartz crystals, to thus speed deliveries of superior radio-communication sets to our land, sea, and air forces . . . Another special x-ray unit helps to speed war planes from the drawing board to the flight ramp, by an ingenious x-ray-photomatte method of duplicating full-scale, exact-size templates directly on the materials to be used in construction . . . These are only a few of the vitally important uses of the x-ray in this great war effort.

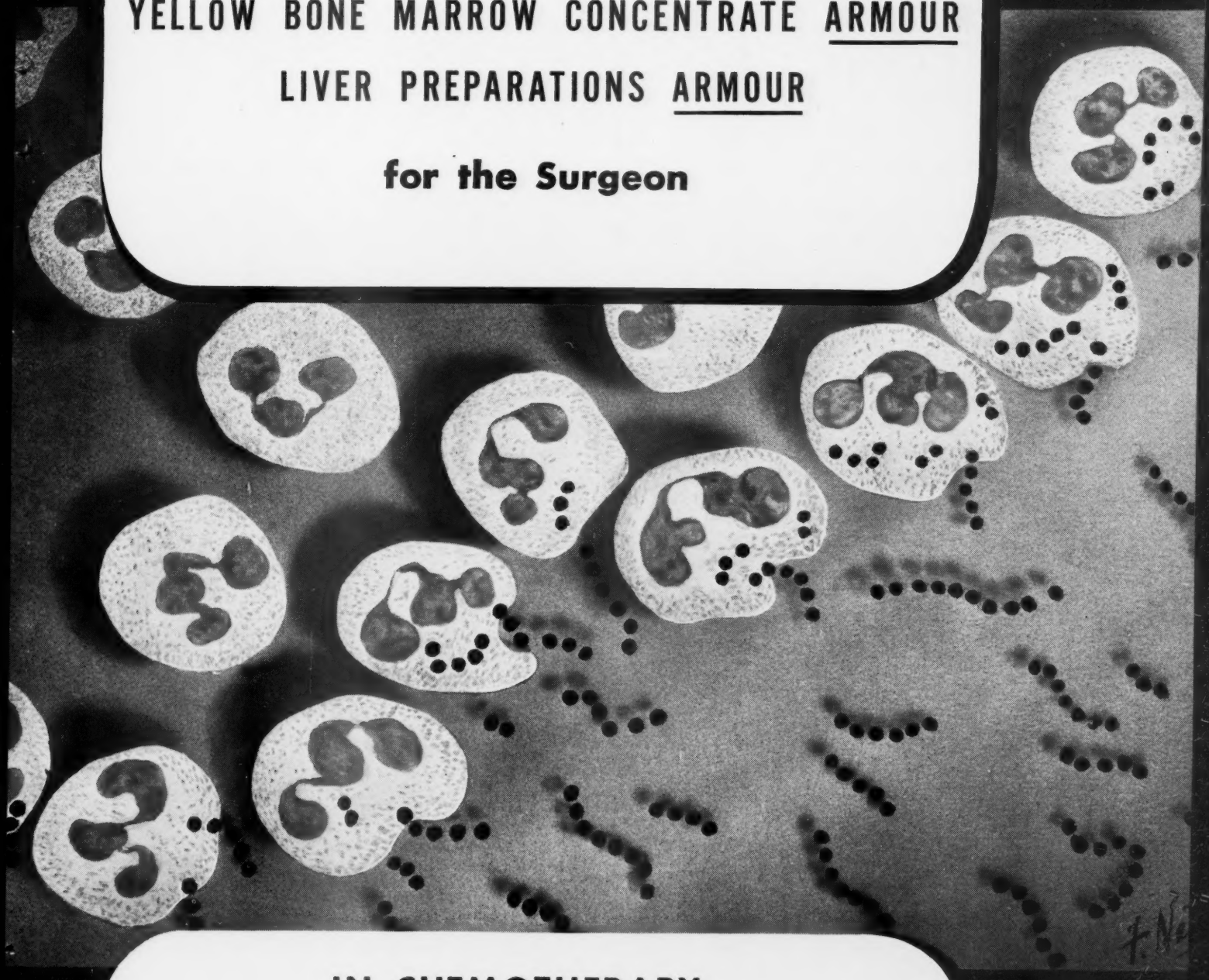
What all this means to you is simply this: that the varied experience we have gained in the development of highly specialized x-ray equipment for industries, is further assurance of our ability to continue to design the finest apparatus for medical radiology.

4 Pages of Data on

YELLOW BONE MARROW CONCENTRATE ARMOUR

LIVER PREPARATIONS ARMOUR

for the Surgeon



IN CHEMOTHERAPY...

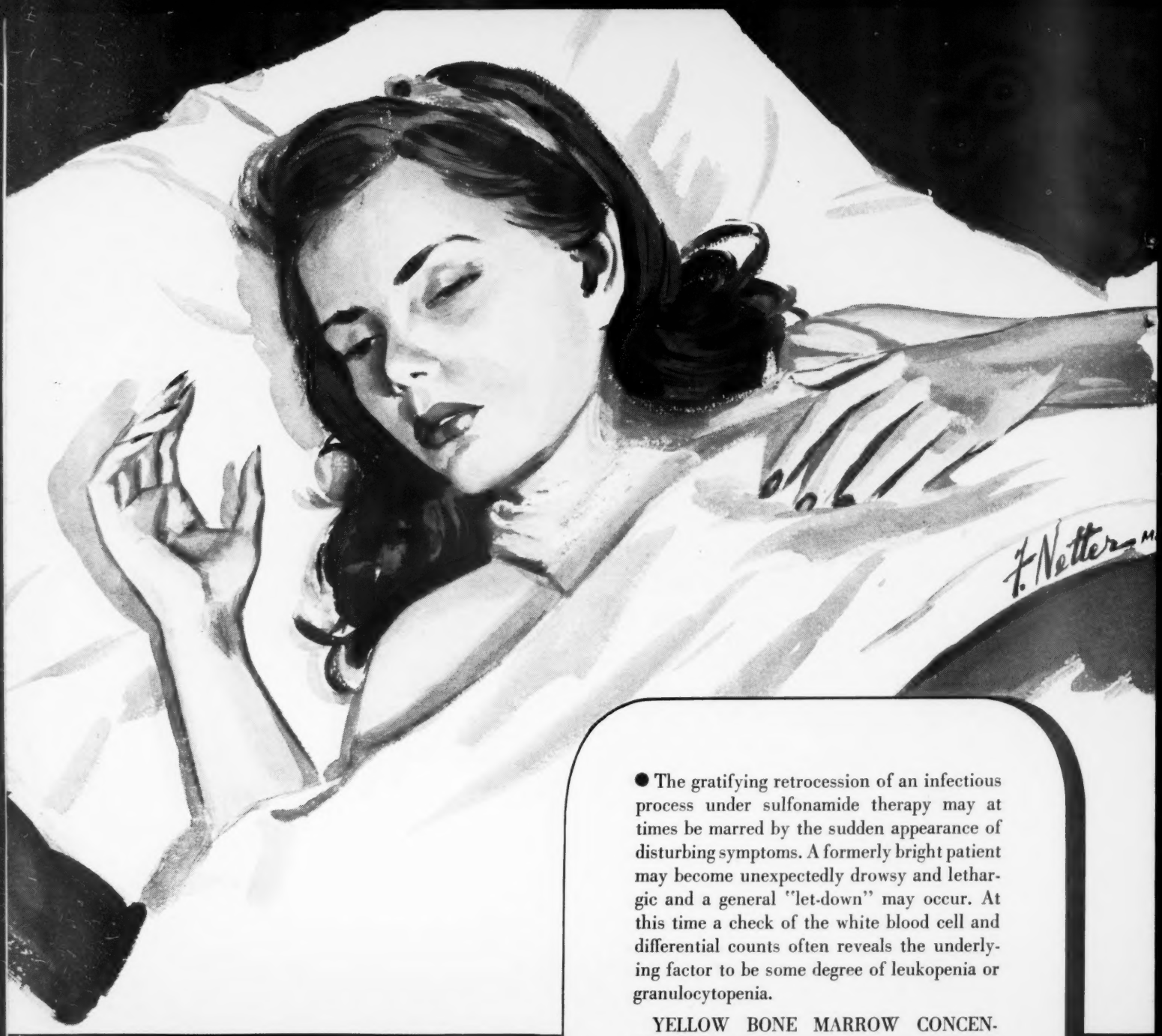
Watch the Leukocytes ... the Body's First Line of Defense

● The leukocytes present in normal blood comprise three main groups... the granulocytes, the lymphocytes and the monocytes. Each type plays some important part in protecting the body from disease. Two-thirds of the leukocytes are granulocytes which are produced in the bone marrow. Their life time is very short—from 3 to 5 days. Continuous renewal, therefore, is essential. Abrupt severe depression of the blood-building mechanism may terminate in leukopenia or agranulocytosis within a short period of time.

The sulfonamides, despite their outstanding therapeutic value, are among the substances which cause a reduction in leukocytes even in normal persons. Whenever chemotherapy is undertaken, therefore, it is essential that the total white and differential cell counts be checked regularly. At the first sign of a marked deficiency in number of circulating white cells, measures should be instituted to stimulate leukocyte production.

For this purpose, YELLOW BONE MARROW CONCENTRATE ARMOUR has been found efficacious. Clinical improvements may be observed within twenty-four hours after initiation of therapy with YELLOW BONE MARROW CONCENTRATE. Distinct increases in white cells occur usually within forty-eight hours.

Yellow Bone Marrow Concentrate Armour



SETBACK

in the Course of Sulfonamide Therapy

● The gratifying retrocession of an infectious process under sulfonamide therapy may at times be marred by the sudden appearance of disturbing symptoms. A formerly bright patient may become unexpectedly drowsy and lethargic and a general "let-down" may occur. At this time a check of the white blood cell and differential counts often reveals the underlying factor to be some degree of leukopenia or granulocytopenia.

YELLOW BONE MARROW CONCENTRATE ARMOUR has been found helpful in overcoming this hazard to chemotherapy. If this preparation is given in adequate dosage, a general brightening of the patient, a decrease in malaise, and other clinical evidences of improvement often appear within 48 hours, and increases in the white cells are apparent soon thereafter.

YELLOW BONE MARROW CONCENTRATE ARMOUR

Have confidence in the preparation you prescribe . . . Specify ARMOUR

Yellow Bone Marrow Concentrate

ARMOUR

AVAILABLE in two forms:

Liquid—½ oz. dropper bottles.

4 minim glanules (sealed gelatin capsules)—boxes of 50 and 100.

DOSAGE:

In severe cases, one teaspoonful every 4 hours until satisfactory clinical and hematologic improvements occur. The dosage may then be reduced as indicated in accordance with individual requirements. It may be administered mixed in ice cream, malted milk, tomato juice, or other agents.

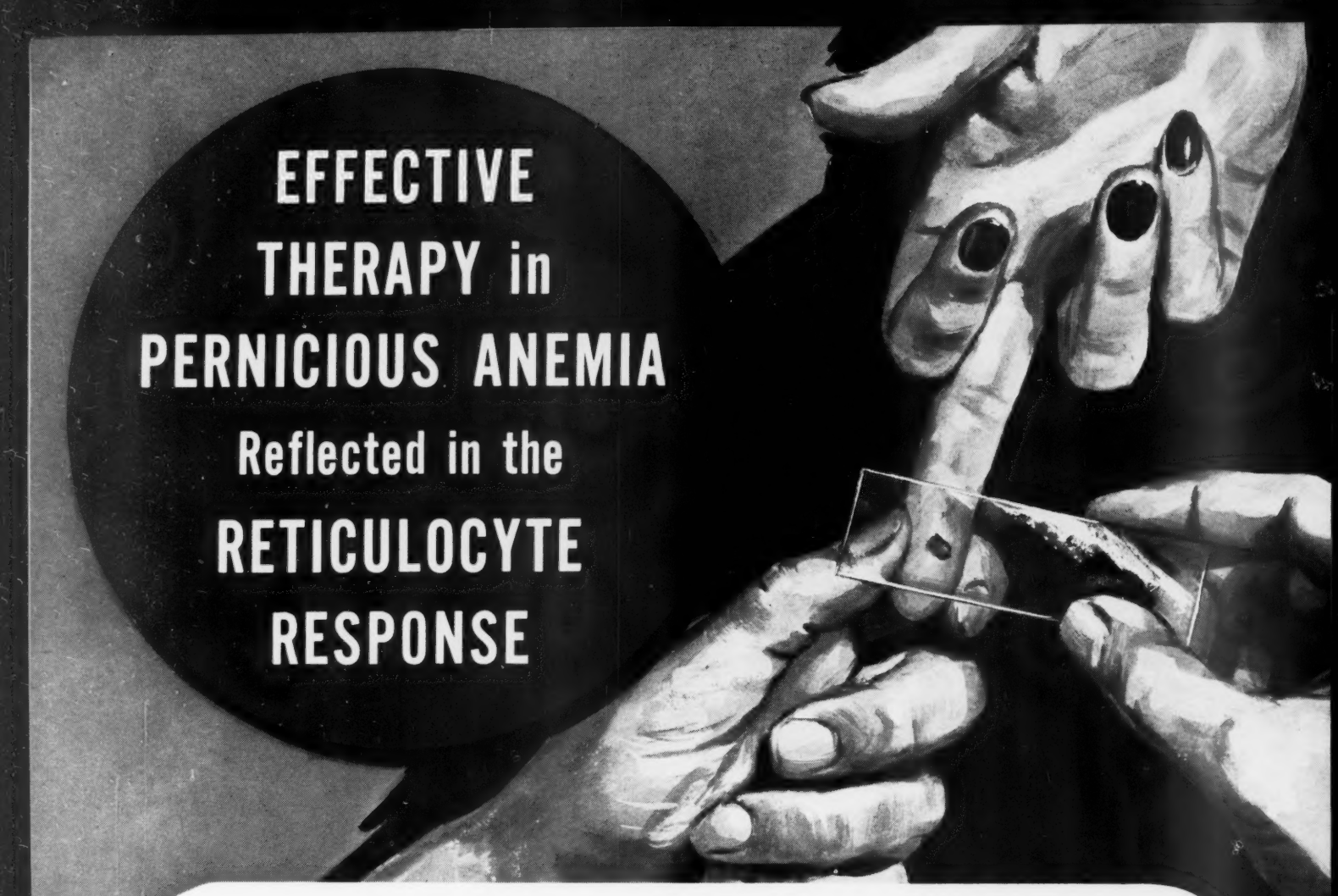
After the critical phase has passed, and in mild chronic cases, the YELLOW BONE MARROW *GLANULES* may be employed advantageously—two or three glanules three times daily.

● Yellow Bone Marrow is the physiologically active fraction of bone marrow which stimulates leukocyte formation. Its equivalent concentration of two grams of marrow per drop has been found quite satisfactory for clinical use.

YELLOW BONE MARROW CONCENTRATE *ARMOUR* has been demonstrated to stimulate the formation of white blood corpuscles—particularly the granulocytes. It is indicated whenever there is a deficiency of these cells due to depression of the bone marrow function caused by certain drugs, bacterial toxins, exposure to benzol vapors, etc. It is applicable both in absolute and in relative deficiencies. It should also be borne in mind that in certain cases the white blood cell count may be lower than might be expected from the fever and clinical condition of the patient. This too may be interpreted logically as a white cell deficiency and therefore as an indication for yellow bone marrow therapy.

YELLOW BONE MARROW CONCENTRATE *ARMOUR* is non-toxic and there is no danger in its use. Even in enormous doses it has little or no influence on the blood picture of *normal* people.

EFFECTIVE THERAPY in PERNICIOUS ANEMIA Reflected in the RETICULOCYTE RESPONSE



● Liver therapy is specific in the treatment of pernicious anemia and is effective in most other macrocytic anemias. Carefully prepared liver extracts contain the hemopoietic fraction necessary for the proper maturation of megaloblasts into reticulocytes.

The patient often experiences a feeling of well-being within 24 hours after beginning parenteral liver therapy. A definite indication of successful treatment, however, is the sharp rise in reticulocytes. For this reason daily reticulocyte counts form the ideal control during the first two weeks of treatment. Renewed production and release of reticulocytes by the bone marrow is reflected in the patient's blood picture by day to day improvement in the quantity and quality of the circulating red blood cells, accompanied by marked clinical improvement.

ARMOUR LIVER LIQUID (PARENTERAL) and ARMOUR SOLUTION LIVER EXTRACT are prepared from selected livers of young, healthy animals. These products are assayed and carefully standardized on pernicious anemia patients in relapse. Their ability to maintain the patient's restored blood count within normal levels is also ascertained.

Have confidence in the preparation you prescribe . . . specify ARMOUR

●

ARMOUR LIVER PREPARATIONS

LIVER LIQUID PARENTERAL

4 U. S. P. Units (injectable) per cc. in 1 cc., 5 cc., and 10 cc. rubber-capped vials. A preparation retaining the secondary hemopoietic factors and most of the vitamin content of the liver.

15 U. S. P. Units (injectable) per cc.—1 cc., 5 cc., and 10 cc. rubber-capped vials. A more highly refined and concentrated preparation for massive dosage.

SOLUTION LIVER EXTRACT (ORAL). 45 cc. equal 1 U. S. P. Unit (Oral). A readily assimilable and therapeutically effective preparation for use when the oral route is indicated or preferred.

THE ARMOUR LABORATORIES • CHICAGO, ILLINOIS

Headquarters for Medicinals of Animal Origin

ACCEPTED AMERICAN MEDICAL ASSN.

Zephiran CHLORIDE

Trade Mark Reg. U. S. Pat. Off. Brand of Benzyl-Trialkonium Chloride

HIGH GERMICIDAL POTENCY

LOW TISSUE TOXICITY

Plus Properties of Zephiran CHLORIDE

- DETERGENT PROPERTIES
- A WETTING AGENT
- HIGH TISSUE TOLERANCE
- PENETRATION ABILITY
- RAPID ACTION
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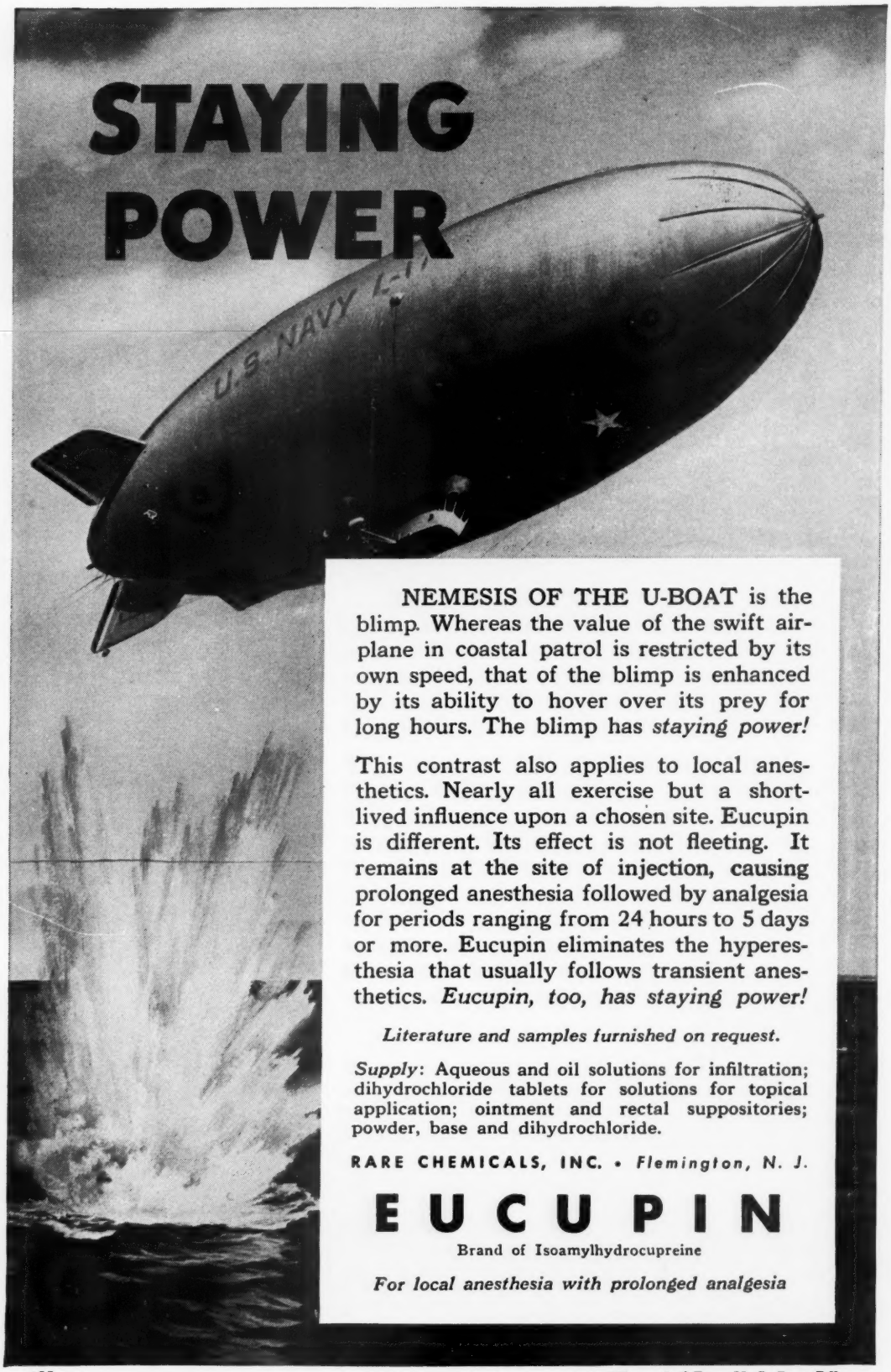
A HIGHLY potent germicide with a low toxicity index is realized in ZEPHIRAN CHLORIDE, cationic detergent and germicide; a mixture of high molecular alkyl-dimethyl-benzyl-ammonium chlorides.

In an evaluation of germicides for clinical use by Hirsch and Novak* using the phagocytosis inhibiting technic for determining toxicity, Zephiran Chloride was found to be germicidal in a 1:3970 concentration sterilizing infected blood completely whereas the phagocytosis inhibiting concentration was shown to be 1:3370. The toxicity index of Zephiran Chloride thus is 0.85 as against an average of 5.2 for 70% and 95% alcohol, and 900 for tincture of green soap.

Zephiran CHLORIDE . . . Germicide for Surgery, Obstetrics and Gynecology, Urology, Dermatology, Eye, Ear, Nose and Throat, Sterile Storage of Instruments.

*Hirsch, M. M., and Novak, M. V.: Evaluation of Germicides with Relation to Tissue Toxicity, Proc. Soc. Exper. Biol. and Med., June, 1942.

ALBA PHARMACEUTICAL DIVISION
WINTHROP CHEMICAL COMPANY, INC. SUCCESSOR
NEW YORK, N. Y.
WINDSOR, ONT.



NEMESIS OF THE U-BOAT is the blimp. Whereas the value of the swift airplane in coastal patrol is restricted by its own speed, that of the blimp is enhanced by its ability to hover over its prey for long hours. The blimp has *staying power!*

This contrast also applies to local anesthetics. Nearly all exercise but a short-lived influence upon a chosen site. Eucupin is different. Its effect is not fleeting. It remains at the site of injection, causing prolonged anesthesia followed by analgesia for periods ranging from 24 hours to 5 days or more. Eucupin eliminates the hyperesthesia that usually follows transient anesthetics. *Eucupin, too, has staying power!*

Literature and samples furnished on request.

Supply: Aqueous and oil solutions for infiltration; dihydrochloride tablets for solutions for topical application; ointment and rectal suppositories; powder, base and dihydrochloride.

RARE CHEMICALS, INC. • *Flemington, N. J.*

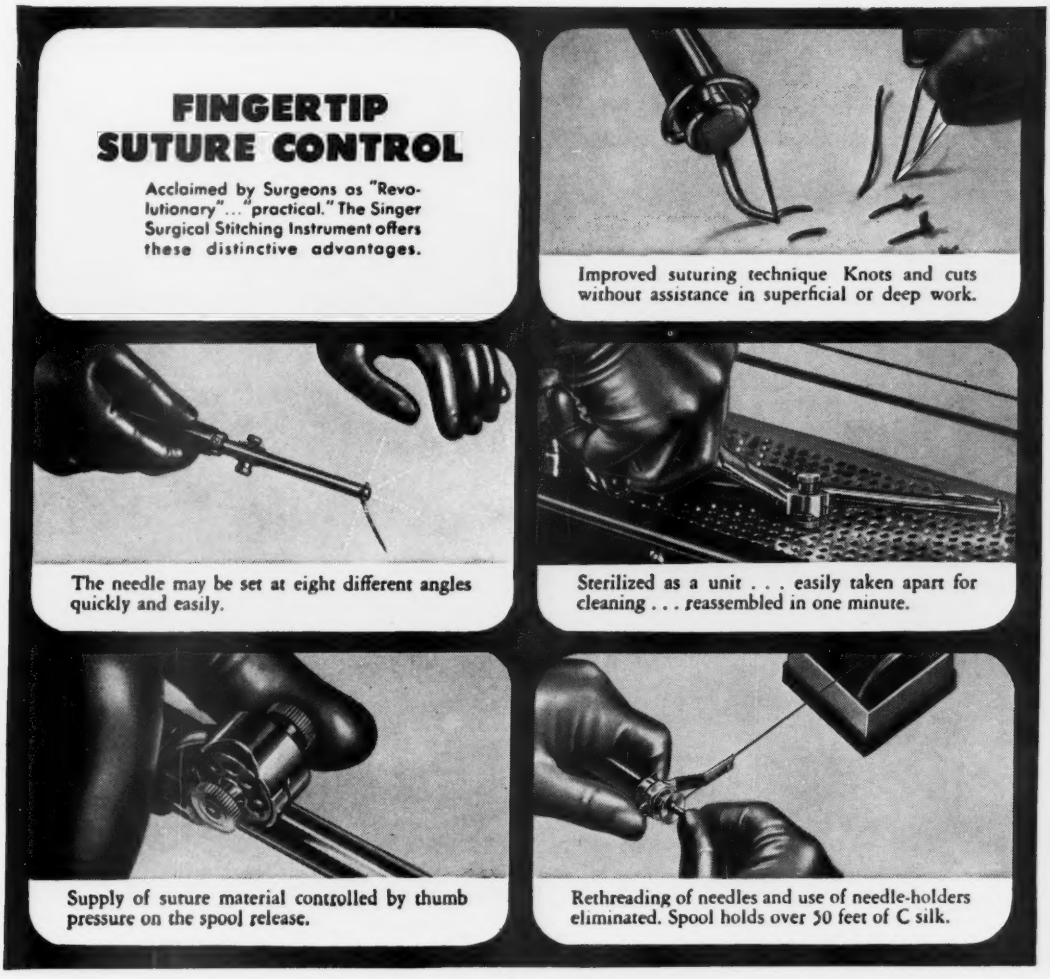
EUCUPIN

Brand of Isoamylhydrocupreine

For local anesthesia with prolonged analgesia

45J

"Eucupin" Reg. U. S. Pat. Off.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SUTURE CONTROL
Acclaimed by Surgeons as "Revolutionary"... "practical." The Singer Surgical Stitching Instrument offers these distinctive advantages.
Improved suturing technique Knots and cuts without assistance in superficial or deep work.
The needle may be set at eight different angles quickly and easily.
Sterilized as a unit . . . easily taken apart for cleaning . . . reassembled in one minute.
Supply of suture material controlled by thumb pressure on the spool release.
Rethreading of needles and use of needle-holders eliminated. Spool holds over 50 feet of C silk.

Operators are offered a variety of interrupted and continuous stitches, some new in surgical technic, effecting more thorough and efficient closure and more postoperative patient comfort.

The Singer Surgical Stitching Instrument may be seen at Singer stores in the larger cities throughout the country. A demonstration may be arranged there at your convenience. Brochure will be furnished on request.

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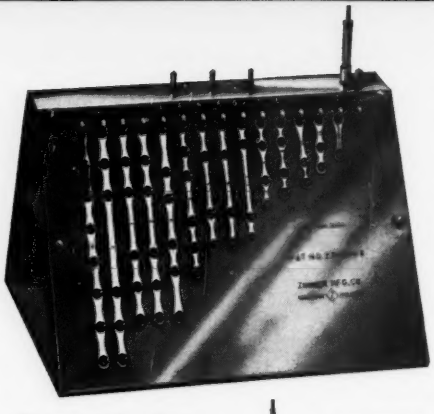
*Designed TO FACILITATE BONE SURGERY——

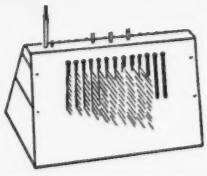
The new Zimmer Bone Plate and Screw Container is devised to facilitate bone surgery by having the drills, screws, and plates of the proper size and diameter sterilized and assorted, ready for use in the operating room.

The new S-M-O stainless steel, noncorrosive and proved the toughest material applicable for bone work, is used in Zimmer plates and screws.

Three complete Zimmer outfits to choose from, including full set of Sherman type or plain pattern plates, screws and drills. Available with, or without, carrying case. For further information write Zimmer.

BONE PLATING CONTAINERS AND EQUIPMENT

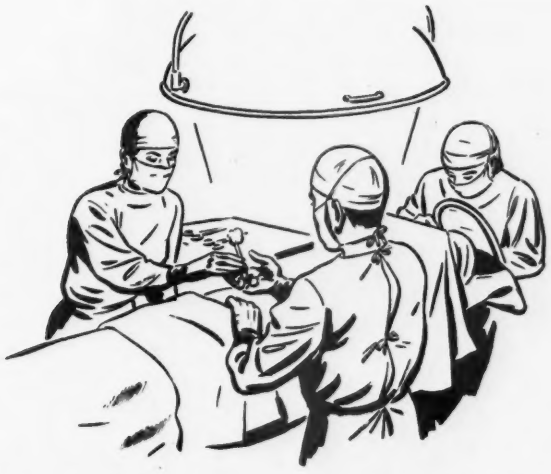




Photograph above shows side of container with bone plates. Sketch at right shows the opposite side of container with screws. Drills are grouped on top of container.

Zimmer
MANUFACTURING CO., WARSAW, IND.

SEND FOR CATALOG OF MATERIAL ON THE COMPLETE LINE OF ZIMMER FRACTURE EQUIPMENT



Phe-Mer-Nite Tincture and Solution offer the surgeon valuable antiseptic properties. As a preoperative skin disinfectant, the tincture (1:3000 alcohol-acetone-aqueous solution) is nontoxic, nonirritant, quickly effective. It produces dependable skin sterilization in 3 minutes. Soap and water readily remove the color. Phe-Mer-Nite Solution (1:1000) retains its high bactericidal power in the presence of blood serum, and finds many uses in every day practice in the physician's office, at hospitals, and in industrial plants.

PHE-MER-NITE

(Brand of Phenylmercuric Nitrate)

Virtually nontoxic. Does not precipitate tissue proteins. Diluted 1:4 (water) the Solution sterilizes instruments and rubber gloves harmlessly in 5 minutes. This Solution may be applied to burns and other lesions requiring antisepsis. Phe-Mer-Nite Tincture and Solution are supplied in gallon and pint bottles. Surgeons are invited to send for literature and liberal clinical test samples.

THE S. E. MASSENGILL COMPANY

Bristol, Tenn.-Va.

NEW YORK • SAN FRANCISCO • KANSAS CITY SEMCO

DEAD BACTERIA *Never* MULTIPLY

Azochloramid

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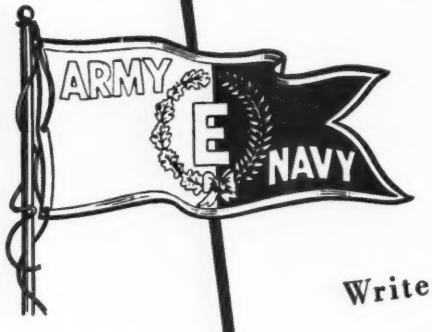
BRAND OF
CHLOROAZODIN, U.S.P. XII

FOR
TOPICAL APPLICATION TO
INFECTED WOUNDS

EFFECTIVE
SAFE



Write for comprehensive literature
and sample of this unique
chlorine bactericide

ACCEPTED
AMERICAN MEDICAL ASSN.
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Pharmaceutical Division
WALLACE & TIERNAN PRODUCTS, INC.
Belleville, N. J.

Basic Facts About:

THE ANATOMIC REDUCTION SPLINT

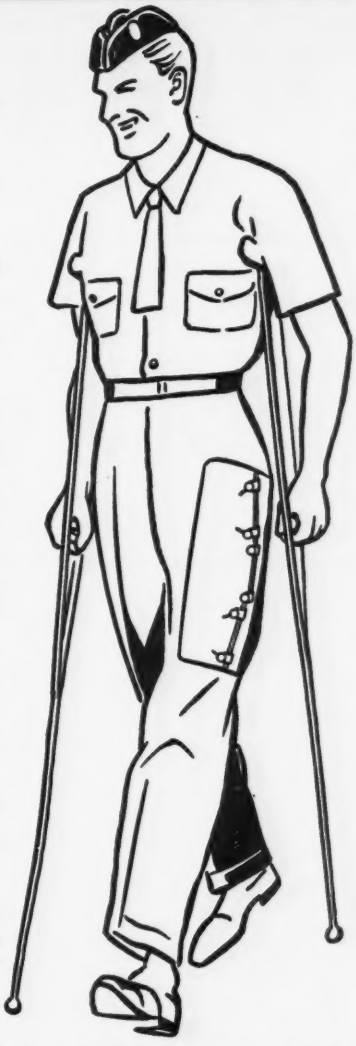
Using the Roger Anderson Technics

This Universal Splint is:

- The only splint that reduces all shaft fractures.
- The only splint that accurately controls fragments in any plane.
- The only splint that permits placement of transfixions where clinically indicated.
- The only splint with normal anatomic rotation—a prerequisite to any reduction method.
- The only splint that does not require preliminary manual manipulation to reduce fracture.
- The only splint with which traction, contaction, angulation are regulated with ease and precision.
- The only splint that unlocks locked fractures.
- The only splint that works with any type or size of transfixion.
- The only splint that permits a choice of technics—castless with pins and rods, pins and plaster, or combination of both.

The adaptability of the splint and Universal Frac-Sure equipment coupled with the Roger Anderson principles of fracture therapy meets the most exacting requirements of military and civilian fracture services.

Booklet on fracture technic and equipment furnished on request. NOTE TO MILITARY AND CIVILIAN DEFENSE HOSPITALS: Technicians available for servicing and demonstrating Universal Frac-Sure Equipment without cost or obligation.



Above femoral fracture completely immobilized with only 11 ounces of Tower Frac-Sure units.

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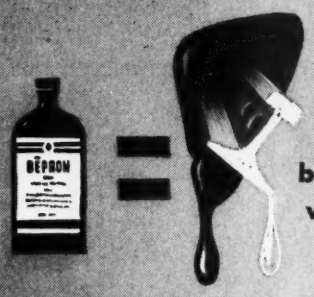
Manufacturing and Research Specialists in Fracture Equipment

IN NUTRITIONAL ANEMIAS

BĒPRON



whole beef liver with iron

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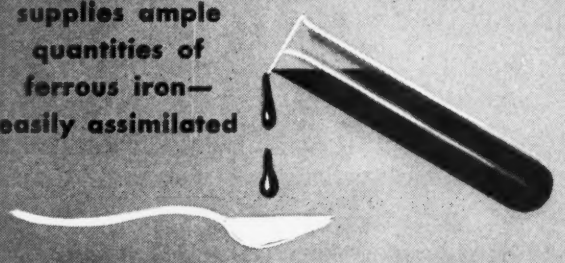
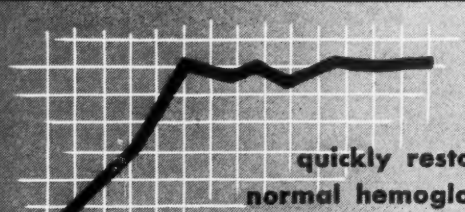
supplies ample quantities of ferrous iron—easily assimilated



it

supplies the materials essential to normal red cell production

all



quickly restores normal hemoglobin levels . . . insures lasting results after treatment

Wyeth's BĒPRON BEEF LIVER WITH IRON
Reg. U. S. Pat. Off.
JOHN WYETH & BROTHER, INC. · PHILADELPHIA, PA.

Answering the many inquiries about Stearns

Amino Acids

for Intravenous Injection

When we first announced the development of Amino Acids Stearns—a safe and effective parenteral substitute for protein alimentation—we believed that we were offering the medical profession a new weapon of primary importance. On the evidence of initial research, the production of Amino Acids Stearns, in fact, gave every indication of being as important an aid to medical science as the isolation and commercial production of vitamins.

Even so, the demand which followed experiments of impartial investigators with this new contribution to the study of deficiency diseases took us by surprise. Almost immediately on its introduction, we were faced with requests from hospitals, clinics, and individual physicians nearly equal to the production planned for years in the future. Moreover, demand is constantly increasing. Despite prompt and continuing steps to augment our output, requests for Amino Acids Stearns still outstrip production.

The foregoing is offered in explanation of our delay in meeting the hundreds upon hundreds of requests for Amino Acids Stearns. To this explanation we can, however, now add this word of encouragement: *Production is climbing so rapidly that in a very short time we expect to be able to meet present demand.*

Meanwhile, thank you for the fine confidence in Stearns indicated by your prompt and enthusiastic acclaim of this new Stearns development. You may be assured that we are doing, and will continue to do, everything possible to assure you an adequate supply of Amino Acids Stearns.

Frederick Stearns *& Company*

Since 1855 . . . ESSENTIALS OF THE PHYSICIAN'S ARMAMENTARIUM

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Blood-Clotting time
controlled by . . .

HEPARIN

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HEPARIN acts quickly. It lengthens the clotting time of the blood as soon as it is introduced into the blood stream. Individual characteristics of the patient, together with the amount of Heparin supplied, determine the actual clotting time.

Heparinized blood ordinarily returns to a normal clotting time within thirty to sixty minutes after discontinuance of the drug. Thus blood clotting time is under control and danger from hemorrhage is reduced to a minimum. Heparin in relatively non-toxic in prophylactic and therapeutic doses.

PACKAGES—Heparin *Lederle*
10 cc. vials

Specify **Lederle**

LEDERLE LABORATORIES, INC., NEW YORK, N. Y. — A UNIT OF AMERICAN CYANAMID COMPANY

The art of anatomic illustration entered a new epoch upon the publication of the Tabulae Anatomicae of Giulio Casserio (Venice, 1627). This female figure is one of Casserio's most beautiful copperplates.

THEELIN AQUEOUS SUSPENSION

For patients requiring high potencies, and for those who do not tolerate oil injections.

THEELIN AQUEOUS SUSPENSION provides the same pure, natural crystalline estrogen as Theelin in Oil, and the same effective clinical results may be expected in the treatment of the menopausal syndrome and other conditions due to diminishing estrogenic secretion. Theelin Aqueous Suspension is administered intramuscularly. Normal saline solution—no suspending agent—is used in preparing this product and the ampoule need only be shaken gently before the preparation is drawn into the syringe.

The uniform potency of Theelin is certified by the Laboratories of both Parke, Davis & Company and St. Louis University. Kapseals Theelol (Oral) and Theelin Suppositories (Vaginal) are available for maintenance therapy and for use in milder hypogonadal conditions.

•

THEELIN AQUEOUS SUSPENSION
1-cc. ampoules, each cc. containing 2 mg. (20,000 I.U.) of Theelin suspended in normal saline solution.

•

THEELIN IN OIL
1-cc. ampoules in strengths up to 1 mg. (10,000 I.U.) of Theelin per cc.

ARMY E NAVY

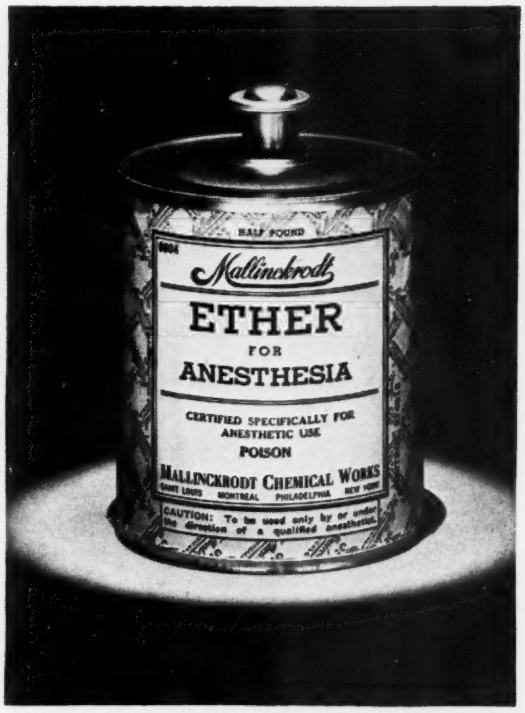
PARKE, DAVIS & COMPANY
DETROIT, MICHIGAN

WHAT'S THE *first anesthetic* YOU THINK OF?

IN ALL surgery the name ETHER has come to be a synonym for anesthesia.

Much effort has been expended in the development of new anesthetics. While in some instances these newer anesthetic agents are preferable, yet most surgeons still regard ether as the anesthetic of choice in the majority of surgical cases.

MALLINCKRODT ETHER for Anesthesia is unsurpassed for purity, stability and uniform potency. MALLINCKRODT'S accumulated years of experience in ETHER production make it a choice of leading anesthetists. Supplied in ¼ lb., ½ lb., 1 lb. and 5 lb. cans.



MALLINCKRODT ETHER FOR ANESTHESIA

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FOR VICTORY BUY UNITED STATES WAR BONDS STAMPS

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76 Years of Service to Chemical Users

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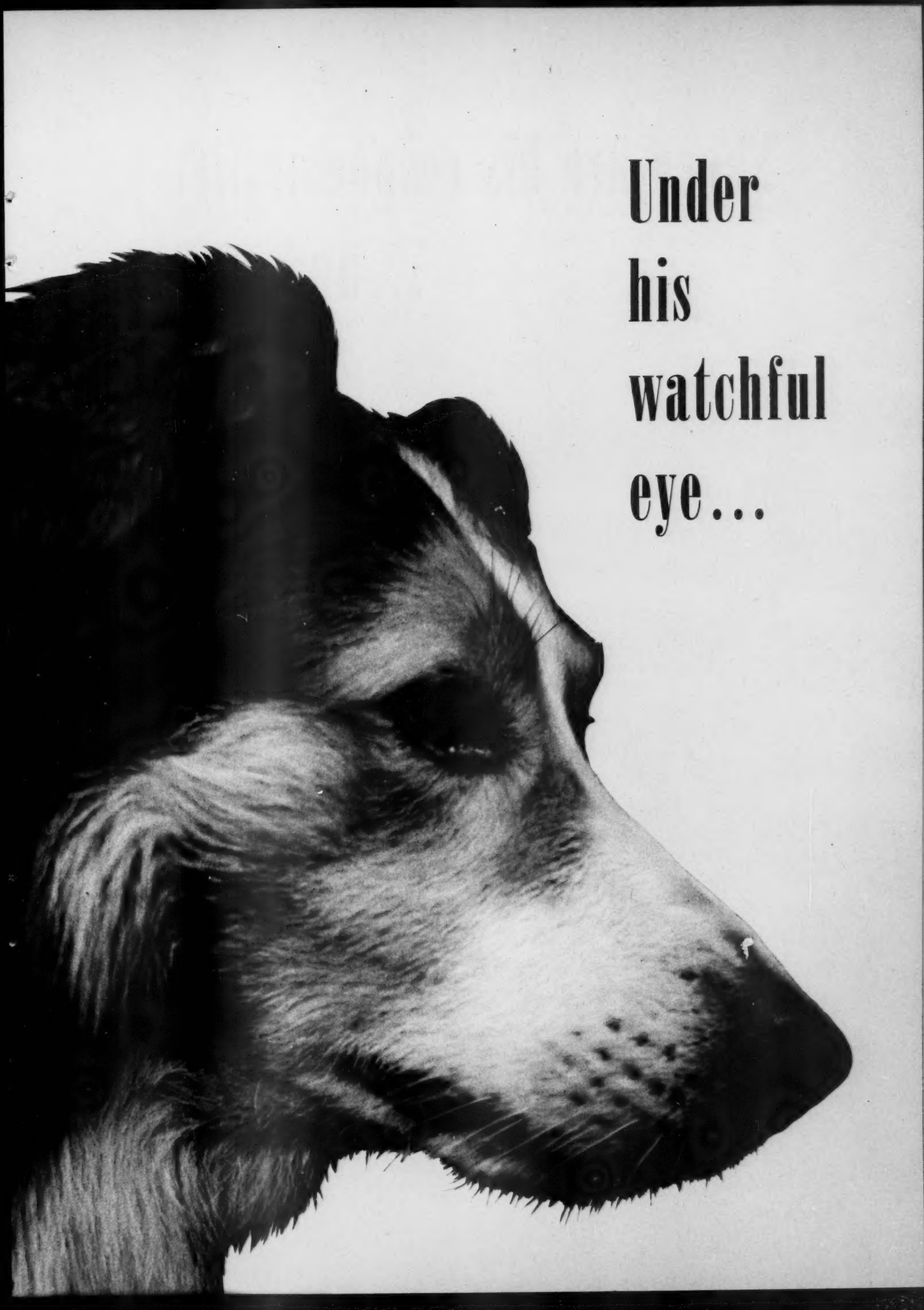
Under
his
watchful
eye...

Sheep are his responsibility ...and ours

● Sheep into Sutures . . . The sheep dog keeps his vigil on the range, the government inspector in the stockyard. But from there on, in the service of surgery, sheep are *our* responsibility, our guardianship, our trust. *We take nothing for granted.* Through every manufacturing process . . . from exhaustive inspection of sheep intestines to the sterile strand in your hand, our own laboratories are vigilant watch-dogs of quality.

Under her watchful eye specimens of Ethicon Sutures are examined for sterility. This is only a small segment of a comprehensive system of inspecting and testing through which full control of the processing of Ethicon Sutures is maintained from receipt of raw material at our Chicago plant to final sealing and packaging at our New Brunswick Laboratory.

ETHICON SUTURE DIVISION

Johnson & Johnson

NEW BRUNSWICK, N. J. CHICAGO, ILL.

SUTURE MANUFACTURERS SINCE 1887

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Fifty-second Year of Continuous Publication

NEW SERIES VOL. LX MAY, 1943 NUMBER TWO

Editorials

EMERGENCY X-RAY EXAMINATIONS IN SUSPECTED SKULL FRACTURES AND BRAIN INJURIES

IN many hospitals it is almost routine practice to hurry cases of head injury to the *x*-ray department to rule out fracture. That such injuries are very frequent is shown by the statistics of the Mocks* who have estimated that 600,000 head injuries, one-third of them proved skull fractures, occur annually and that with an average mortality rate of 10 per cent for serious head injuries without fracture and an average death rate of 30 per cent for proved skull fractures, nearly 300 persons die each day in the United States from brain injury.

This note is intended to encourage greater conservatism in the employment of the immediate *x*-ray examination of severe skull injuries on their arrival at the hospital for emergency treatment. We see numerous instances of skull injury with the patients in shock and completely unable to cooperate with the radiologist in the *x*-ray examination. Some patients are unconscious, some are greatly excited; most of them do not fully comprehend the necessary instructions given during the course of the *x*-ray manipulations.

As pointed out by the Mocks the most dangerous period of cerebral shock occurs during the first six hours; it causes many of the earlier deaths. Every patient with a head injury should be treated during the first hour or two after admission as a case of potential shock unless menacing hemorrhage threatens his life. This is no time for *x*-ray study.

It should be a rule, of course, as Mock has emphasized, that an *x*-ray examination should be made in every head injury "but never in the presence of cerebral shock." The writer has been impressed that there seems to be undue haste in rushing emergency skull cases to the *x*-ray department. This seems to have been true in the group of Mock's collection of cases which did not do well. If there are associated injuries, e.g., in the extremities, the temptation for early *x*-ray procedure seems to be still greater; and with such patients it has been the case that not only the suspected extremity but the skull have been submitted to *x*-ray study.

The writer urges that in suspected skull fractures in severely injured patients it be the general rule to delay the *x*-ray examination, perhaps for days. With the possible exception of those cases in which the suspected fracture seems to be located over the middle meningeal artery the immediate treatment of the case is not going to be changed by the *x*-ray findings. Even in these instances of suspected hemorrhage a bedside *x*-ray examination can be done.

* Mock and Mock. Management of skull fracture injuries and brain injuries. *J. A. M. A.*, 120: 498–505, 1942.

When the patient has been brought into good condition, the *x*-ray procedure should be ordered. In this stage the patient can be moved to the *x*-ray department, unless his associated injuries prevent it. Even in the latter event a bedside study with the aid of grids will produce films satisfactory in the diagnosis of most fractures.

Of course, at some time before he leaves the hospital every case of head injury should have a thorough examination with the *x*-ray. As Max Peet has stated, "this examination is made largely as a matter of record and in preparation for possible medicolegal complication."

One sometimes hears the remark that there are many skull fractures which cannot be demonstrated by the *x*-ray. This is a statement which is probably true of many hurried *x*-ray studies, but it need not be so. When the patient is in proper condition, a thorough examination should be carried out, which means that to the ordinary films should be added a submental-vertex film and films, preferably stereoscopic, in the Towne's position. A thorough *x*-ray investigation of the skull for fracture should always include postero-anterior, antero-posterior (Towne's position), submental-vertex, and right and left lateral films. These will constitute a complete survey of the cranium, including its base. Stereoscopic films are always helpful. It is very unlikely that a skull fracture should escape such a complete investigation.

JAMES T. CASE, M.D.

AN HISTORICAL EVENT AND A GREAT PHYSICIAN

OUR great, great-grandchildren, and their great, great-grandchildren will refer to December 7, 1941, as "Pearl Harbor." On that day the Japanese attacked our country without a declaration of war and without warning. Pearl Harbor will go down in history alongside of Valley Forge, Bunker Hill, Yorktown and Gettysburg. At Pearl Harbor, on that memorable day, was a great physician and executive, a man of whom the Navy should be and, no doubt, is proud—Captain Reynolds Hayden.

Captain Hayden was in charge of the hospital at Pearl Harbor, and in the following pages he gives us a graphic account of that terrible day and the following two or three days. The first seventy-two hours must have been hell. Captain Hayden has written an absorbing and interesting report of that raid and the part the hospital doctors and personnel played when large numbers of severely wounded were rushed to the hospital already filled to capacity. The article is told with restraint; even the scientific part is done modestly; nowhere is there a suggestion of rodomontade. When we received this manuscript we read every word with increasing interest. We wished it were longer; and we know you, too, will find every word absorbing, and that when you finish reading it you will feel and know that Captain Hayden and his co-workers, physicians, nurses and volunteers, did an epoch making, marvelously efficient job.

T. S. W.

A SUGGESTION

THIS is not original. Would it not be well for our government to give some kind of button or emblem when a young man at his induction physical examination is not accepted in the armed forces because of physical disability? This goes for young physicians, too. At times it is embarrassing and mentally painful for a young man, apparently healthy externally, to be stared at by people who wonder "why you are not in a uniform . . . a young man like you?" The young man cannot cry out, "I have two perforated ear drums," or "I have nephritis," or "both my legs below the knees are off." How about it?

T. S. W.

Original Articles

ACTIVITIES OF THE NAVAL HOSPITAL AT PEARL HARBOR FOLLOWING THE JAPANESE AIR RAID OF DECEMBER 7, 1941

COMMENTS ON THE CARE OF BATTLE CASUALTIES

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MORE than a year has passed since the surprise Japanese air raid on Pearl Harbor, an attack which was typically Japanese in thought and execution, which finally pushed us into the second World War and which was to have a markedly serious effect upon the allied war effort in the Pacific Ocean and Asia.

While a great deal has been published about the raid, the naval hospital there went through an experience which was a very concrete example of what may occur at any hospital in an area subject to air raids, an experience which largely revolutionized and stabilized the treatment of war wounds and burns. While the tremendous pressure of work in caring for casualties under air raid conditions can only be experienced, not described, it is believed that a description of the activities at the Naval Hospital, Pearl Harbor, on that fateful December 7th will be of interest to all and possible assistance to some in handling a similar situation elsewhere.

It must be emphasized that war surgery is not civil surgery. It is necessary to get away from the leisurely surgery of civil life. The treatment of battle casualties means the treatment of mass casualties because occasional casualties are routine at any hospital. In battle and especially in the presence of an air raid, a great number of casualties are received in a short space of time, so that the number of patients requiring prompt treatment is out of all proportion to the number of doctors immediately available. All that is possible at first is what might be called advanced first aid: morphine, control of hemorrhage, prevention of infection and treatment of shock.

Speaking medically, the air raid on Pearl Harbor had three very unusual features. These were, first, the great number of casualties received at hospital in a short period of time; second, the fact that many patients had been overboard and were covered with fuel oil; third, the very high percentage of burn cases.

As you know, the enemy air raid on Pearl Harbor was a great surprise to us all. It occurred shortly before eight o'clock on a beautiful, quiet, peaceful Sunday morning such as is seen in any small town in the United States. I was in my quarters on the naval hospital reservation when I heard the roar of planes passing overhead. This was immediately followed by a loud explosion. I did not pay much attention to it because the naval hospital was located alongside the Army Hickam Air Field and across the channel from the Naval Air Station on Ford Island. We had planes

flying about us a great part of the time. Dynamite was being used in connection with construction work in the rear of the hospital. The explosion of 300 to 500 pounds of dynamite sounds quite similar to that of an air bomb. Then I heard more planes and more explosions. That was not quite normal and I started for the window to see what was going on. Just then my young son Billy, fourteen years old, dashed in the room and shouted, "They're Jap planes!" I asked, "Jap planes?" He said, "Yes, look at them" and pointed out the window. I looked out the window and three of them went by the second floor of my quarters and about seventy-five feet away. They were so close that the features of the aviators could be easily distinguished. The planes approached from the sea, flying low and hiding behind the hospital buildings so that they would not readily be seen. They did not attack the hospital but hedge-hopped over it en route to military objectives.

I told my family to stay in the house and immediately went to the hospital where the officer-of-the-day was already getting all hands to their stations, distributing additional supplies to operating and dressing rooms, scattering ambulances and fire fighting apparatus about the hospital grounds so that they would not all be destroyed at once, etc. A considerable number of our ambulant patients were rapidly transferred from the wards to hospital tents in the rear of the hospital so that their beds would be immediately available for casualties. Quite a number of patients who were practically well or awaiting return of their ships to Pearl Harbor so they could be returned to duty urgently requested immediate discharge to duty so that they could join some unit and fight.

About ten minutes after the raid commenced, a Jap plane ablaze was seen coming down on a glide toward the center of the hospital. It looked as though it was going to make a direct hit on the middle of the main hospital building but very fortunately veered off a bit, carried away a corner of the roof of the laboratory and about half of our animal house and crashed on the tennis courts alongside the hospital. It brought up alongside a frame house which immediately caught fire. Both fires were promptly extinguished by the hospital force. The Japanese aviator had been shot in the head and killed before the plane crashed so that it evidently came down entirely out of control. We considered ourselves very lucky.

A disturbing factor throughout the day of the raid was the reports over house short wave radio sets that the water had been poisoned, that many Jap transports convoyed by war ships were landing troops here and there on the coast, etc. It was at first stated that our Army and Marines were keeping off these landing parties. About the middle of the day, it was reported in detail that large numbers of Japanese troops had landed on the north coast and were pushing back our troops. We were too busy to worry about such reports but, though I actually knew nothing about it, I tried to keep them from our people and said they were incorrect. The poisoned water rumor was most persistent and quite alarming to many but was finally disproved by water analyses. These reports were spread by short wave radio sending apparatus manned by Japanese fifth columnists in scattered houses, stores and cane fields. They were gradually located during the day and all the Japs handling them were shot.

About an hour after the raid started, we moved the hospital families living on the reservation from their quarters into the basement of the hospital where they were pretty well protected by reinforced concrete. They slept there until they were evacuated to the mainland on Christmas Day. I have frequently complimented these women and children upon the way they took all this. They were naturally frightened but were quiet and absolutely no worry to the rest of us—except for their presence. Under the circumstances, we would have preferred them to be in San

Francisco. It was, of course, impossible for us to have any real Christmas celebration but on Christmas Eve, our Red Cross Field Director got a small tree and trimmed it with some tinsel and ornaments. One of the doctors dressed himself up as Santa Claus and handed out some little present to each member of the families. While the occasion lacked the joyous frivolity to which we had all been accustomed for Christmas, the occasion was really very impressive and enjoyable. It made them all feel much happier and temporarily forget the next day when they were all to be evacuated and knew that they would have to run the gauntlet of Jap submarines between Honolulu and San Francisco.

We received our first casualty shortly after the raid commenced. It was a man who had been walking with his wife and baby down the road alongside the hospital. A shell fragment had carried away his left arm and part of the shoulder. He died soon after admission to the hospital.

About a half-hour after the raid commenced, we really began to receive casualties. We received them at an average of three a minute for the next three hours. They were brought to the hospital in all types of vehicles: ambulances, military and civilian trucks, private cars and delivery wagons. They were brought in by all manner of civilians. It was most inspiring to see the way they co-operated in bringing casualties to the hospital under fire. They evidently had no thought of possible injury to themselves or to their cars.

The immediate handling of such a flood of patients was quite a problem but successfully solved by distributing them to all wards and the main operating suite as they arrived. A receiving ward would have created a hopeless bottleneck. This distribution of patients was directed by the Commanding Officer and the Executive Officer. All other doctors on the hospital staff were working in the various wards with four operating teams in the operating suite.

The badly wounded, those demanding immediate surgical attention, were sent directly to the operating amphitheatre as rapidly as possible. While an effort was made to allocate other patients to wards in accordance with their types of injuries, each ward actually received many varieties of casualties. As a result, it was necessary to re-group the patients during the next two days by transfers from one ward to another in order to group similar classes of casualties together in the same ward or wards. Approximately 47 per cent of all casualties admitted were cases of burns. With the exception of some patients suffering from excessive inhalation of smoke, blast effect of high explosives, etc., the remainder were acute surgical emergencies.

Upon admission, all patients not known to have been previously morphinized, were given ½ gr. morphine sulphate hypodermically followed by tetanus antitoxin, 1500 units, alone or combined with anti-gas serum. All service personnel have now been given tetanus toxoid and are immunized against tetanus. At the outbreak of war, however, many had not yet received the toxoid. Tetanus antitoxin was therefore administered. With casualties arriving so rapidly, it was necessary to assign a group of doctors and nurses to the morphinization of patients. The usual technic of administering hypodermic medication was of course totally inadequate for this occasion. A solution of morphine sulphate gr. ½ to 1 cc. and a tray of sterile hypos in alcohol were therefore prepared. This enabled the administration of morphine to keep up with the flow of patients. All patients given morphine at the hospital that first day had a red M marked on their foreheads with mercurochrome in order to prevent their getting another dose for at least several hours. Preliminary cleansing of patients was impossible. While many were covered with fuel oil from head to foot, comparatively scant cleansing was all that could be done in this respect at the first treatment.

For the first three days after the raid, it was necessary for the entire hospital staff

to work twenty-four hours a day, snatching what sleep they could. For the next ten days, doctors, nurses and hospital corpsmen were divided into watches in order that the necessary work might be continued night and day. The operating suite had been previously blacked out and four operating teams worked in relays of two teams each for several days.

SHOCK

Upon admission, practically all patients were suffering from shock in varying degrees. Most deaths in the hospital occurred within twenty-four hours of admission and were due to either acute or delayed shock. The great importance of the prompt treatment of shock in the handling of battle casualties were impressed upon us all. It takes precedence over all other treatment except control of hemorrhage. Hemorrhage and shock account for most of the deaths on the battlefield. Some patients are hysterical and others depressed; all exhibit great anxiety; practically all are in pain. Both for pain and as first treatment for shock, these patients need ½ gr. of morphine promptly. Following this and the routine of heat locally, came the intravenous administration of blood plasma, saline and glucose, or normal saline solutions.

It is extremely important that shock be controlled in severely wounded patients before any other treatment is instituted except immediately necessary first aid. If hemorrhage and shock cannot be adequately controlled, it is a waste of time to send a patient to the operating room. With both the Army and Navy at Pearl Harbor, some casualties received in the operating suite had to be returned to their ward for more shock treatment before they could be operated upon. With extensive burns, however, a first spraying or other local application may be done simultaneously with early shock treatment.

ACUTE SURGICAL CASES

A great variety of surgical cases were admitted: gunshot and shell wounds, large and small, of all parts of the body; extensive wounds produced by bomb or shell fragments; traumatic amputations; wounds containing many metal fragments; simple, comminuted and compound fractures, large and small, some into joints and some with considerable loss of bone.

Upon admission to the hospital, these patients were immediately taken to a dressing room where a preliminary treatment was given. The wound was grossly cleansed, readily accessible metal fragments and badly torn skin and muscle removed, hemorrhage controlled, sulfanilamide powder poured or shaken generously into the wound and an occlusive dressing of sterile plain or vaseline gauze applied. We found the simplest method for handling the sulfanilamide powder was to shake it in from a salt shaker. No wound closure was attempted at this time. Fractures were reduced so far as practicable at a first dressing and a retention apparatus applied. The patient was then put to bed awaiting surgery and given shock treatment if necessary.

Following this preliminary treatment, patients were operated upon when time permitted and in accordance with the urgency of the case. Patients having fractures were *x*-rayed for further diagnosis when time permitted, usually on the second or third day.

At operation, wounds were thoroughly cleansed and then thoroughly débrided until there was normal appearance of tissue, bleeding and, in case of muscle, contraction. The entire wound was then again thoroughly frosted or dusted with sulfanilamide powder.

Sulfathiazole powder was used occasionally but was unsatisfactory. It formed a plastic cast which caused wound secretions to be retained and local infection did not seem to be as well combatted.

Wounds of the extremities were not closed unless very superficial or more than three days had elapsed since injury. These wounds should not be closed at the time of the first dressing. With both Army and

Navy, practically all wound infections occurred in patients who had received primary suture at the first aid station. The efficacy of this procedure is attested by the fact that less than 1 per cent of infections occurred in the large number of wounded treated by the Army and Navy after Pearl Harbor. Approximately the same results have recently been reported from the Solomon Islands area.

More than half of our fractures were compound. These were treated as I have outlined for other large wounds, the fracture reduced and a plaster cast applied, skeletal traction being incorporated in the cast as necessary.

The Orr-Trueta plaster cast technic was used by us for all cases of fracture and all patients having massive or extensive wounds of the extremities without fracture. Severe wounds of the soft parts demand splinting just the same as fractures do.

In fractures of the bones of the upper extremity, traction is usually not necessary. In war surgery especially, plaster of Paris is preferable but this is not always available in the field and these fractures may also be immobilized for transportation by the use of wire ladder splints, boards, folded newspapers, etc. Fracture of long bones of the lower extremity, however, will usually require traction. If plaster is not available, the Thomas splint is usually used. These splints frequently have to be applied under extremely difficult circumstances. Our hospital corpsmen at sea and in the field are trained to apply one to a leg properly in two minutes blindfolded.

Special attention is invited to the fact that our experience at Pearl Harbor definitely showed that sulfonamide therapy, both local and general, has revolutionized the treatment of wounds. Much has been written on this subject but our experience, gained through necessity, completely demonstrated that the free local use of sulfanilamide powder in wounds permits us safely to select the best time to operate upon these patients, with late débridement and other necessary surgery. Its use has forever removed the bugbear of military surgeons, infection occurring in wounds not properly operated and débrided within the so-called "golden period" of six hours after injury. Cases too numerous to mention proved this point. Massive, lacerated and torn wounds, sometimes complicated by severe compound fractures, and which had received only the barest essentials of preliminary surgery plus sulfanilamide powder freely in the wound, were operated upon the second and third day after injury with excellent results. Of the many cases so treated, only one patient had a temperature over 99°F. during his stay in the hospital. At operation, these wounds were all found to be essentially clean and healthy. Infection was only found in those patients who had been given primary suture before arrival at the hospital.

Our naval medical records show that the use of sulfonamides and blood plasma has reduced the death rate forAmerican troops wounded in the Solomon Islands to less than 1 per cent as against a rate of 7 per cent in World War I of all American soldiers wounded in the field.

Only one case will be mentioned in detail. This man had extensive, lacerated wounds of the lower third of each thigh involving the hamstring muscles. At first dressing, these wounds were grossly cleansed, generously filled with sulfanilamide powder and an occlusive dressing applied. By chance, he was not sent to the operating room for about seventy-two hours. At operation, the wounds were found to be clean and showed no evidence of infection. They were thoroughly débrided, severed muscles were sutured, more sulfanilamide applied and the wounds closed. Healing was by first intention.

All severely wounded patients also received sulfanilamide by mouth in routine dosage for several days to a week after injury. In severe cases, this was a necessary adjunct to local use of the drug.

Follow-up reports on these cases some seven weeks later, after they had arrived on our West Coast, stated that practically

all these wounds were clean, uninfected and rapidly healing. In the few instances in which suppuration was present, and this was never extensive, it was associated with the presence of a foreign body. With removal of these and adequate treatment, healing progressed rapidly. In numerous instances, the wounds had healed or secondary plastic closure had been obtained within seven weeks after the patients had been wounded. Following Pearl Harbor, some doubt was expressed that the positions of the bones in compound fractures treated by the sulfanilamide-Orr-Trueta method would be good. But on the West Coast, it was found that in fractures below the knee, with the exception of occasional moderate angulation which it was not necessary to correct, the fragments were in excellent position for a good functional result. There was no *x*-ray evidence of osteomyelitis. In the fractures of the femur, the plaster method was not so satisfactory in maintaining position but there was no infection.

We had one patient who suffered a compound fracture of the thigh with about a four inch loss of continuity in the upper half of the femur. He was given routine treatment so far as the wound was concerned and the leg put up in a plaster cast with traction so that the limb was of approximately the same length as before injury. It was hoped that sufficient periosteum remained to produce regeneration of bone. This patient was evacuated to a hospital on the West Coast. I was told last Spring that he was making good recovery but that there had been inadequate regeneration of bone and non-union. He will recover, however, with perhaps a three inch shortening of the leg. This is a much better result than the high amputation which would have been necessary if this line of treatment had not been followed.

A certain number of cases are received in which emergency amputations are necessary. In selected cases in which the patient is in good condition and adequate operative facilities are available, amputation with flap and primary suture is probably justified. The vast majority of such battle casualties, however, are received under adverse circumstances. In them, a guillotine type of amputation is usually advisable, all structures being cut across at the same level and the wound treated as any large open wound. Later, attempt must be made to cover the bone end with soft parts or re-amputation done if necessary.

Most of our anesthesia was by drop ether. This lends itself well to this type of surgery and in addition, when necessity demands, it may be given by those with little training.

At Pearl Harbor, we had a small amount of the then new sulfallantoin ointment for trial. We found that its use appeared to hasten the "cleaning up" of open wounds. Wounds that ordinarily required a week or more to present healthy granulating surfaces showed a healthy red color in two or three days and were ready for further treatment. A through-and-through wound of the thigh cleaned up very nicely under this treatment but markedly retrograded when the ointment gave out and other treatment was used. The cases in which sulfallantoin ointment was used included both bullet wounds and extensive shell wounds.

SPECIAL REGIONAL SURGERY

While on the subject of surgery, I want to emphasize briefly a few points about war surgery of the head, chest and abdomen.

Head. The majority of penetrating wounds of the head, although not immediately fatal, will result in death unless the wounds are properly treated from the beginning. Improvement of the technic of brain surgery by Dr. Harvey Cushing during the first World War reduced the mortality of these wounds from 60 to 20 per cent. The use of sulfanilamide has now produced a further decrease.

The wounds are usually compound depressed fractures. The scalp wound is often quite small and easily missed on examination but beneath these the *x*-ray will show

an extensive fracture and a missile in the brain. The hole in the outer table of the skull is usually small and that in the inner table many times larger. Bone fragments are carried into the brain, act as missiles, and cause much more damage than suspected.

Success in treatment of these wounds depends upon: (1) preliminary treatment at time of injury, (2) time of operation and (3) nature of operation.

All wounds of the scalp should be considered as serious. Even without associated skull fracture, these wounds are dangerous because of possible infection. Our ideas concerning wound infection have changed with the war. It is now known that many of the more virulent organisms do not enter the wound with the missile but are introduced when it is being dressed. The chief danger to the patient is from the mouths, throats or fingers of those who first inspect and treat the open wound.

Final suture and closing of scalp wounds, even without associated skull injury, should be done only in a properly equipped operating room where the wound can be properly and completely cleaned, débrided and sutured as any other wound, and skull fracture or brain injury properly treated if present. At the time of the first emergency dressing, all hair should be cut from the head or at least from about the wound itself. The wound edges should be cleaned with soap and water if available and the wound filled with sulfanilamide. A large, tight, sterile dressing is then applied. This will usually control hemorrhage. Morphine is contraindicated unless there are extensive painful wounds elsewhere. It should never be used routinely.

If circumstances are such that the patient cannot be transported within a reasonable time to a place where complete operating facilities are available, as thorough a surface operation as possible may be performed in the field dressing station. While this leads to primary healing of the scalp wound without treatment of the possibly co-existing skull fracture or brain injury, these can be safely treated later if the scalp wound has healed and there is less danger of infection than if the scalp wound is left open indefinitely.

Upon arrival at the hospital, the usual examinations are made to determine extent of injury. In taking *x*-rays, a dark film must be obtained as bone fragments and perhaps the foreign body itself may be missed with an underexposed *x*-ray.

Operation should be done as soon as practicable, preferably not later than six hours after injury. If the wound is given the preliminary treatment previously described, however, the operation may be delayed as much as forty-eight hours and the wound still be treated as a fresh wound and closed without drainage. After that time, it is treated as an infected wound and left open.

The most important part of the operation is a thorough cleansing and débridement of the wound tract in the brain. This may contain hair, dirt, grass and fragments of bone. Damaged brain tissue and blood clots are removed by suction and all foreign material carefully picked or gently washed out of the wound. The tract is then gently irrigated with large quantities of sterile saline solution, all bleeding controlled, the wound tract filled with sulfanilamide powder and the wound closed. Sulfanilamide is nonirritating to the brain and as effective in wounds there as elsewhere.

The missile should be removed if reasonably accessible but, if small and deeply buried, it should be left alone.

The wound in the dura must be closed. If it cannot be drawn together, it should be patched by a piece of periosteum or fascia lata.

Postoperatively, sulfonamides are given routinely. Pain may be controlled by aspirin. Barbital or other anticonvulsant drug should be given in small doses and continued for about a year.

In patients operated upon more than forty-eight hours after being injured, the wound tract should be cleaned and dé-

brided as just described, the entire wound filled with sulfanilamide up to the skin and the wound tract loosely packed with vaseline gauze or sterile gauze strips surrounded by rubber tissue.

Face wounds, while revolting, require no special treatment except in connection with the tongue. If the lower jaw and anterior attachments of the tongue are shot away, it tends to fall back into the throat and choke the patient. The tongue must be held forward. This is readily accomplished by placing a safety pin or suture through the midline of the tongue and pulling it forward. This also aids in controlling hemorrhage from about the base of the tongue. These patients should be evacuated face downward.

Chest. These wounds permit air to rush in and out of the pleural cavity, cause marked shock and death, and must be promptly closed if the patient is to live. They may be closed with a pad of gauze from the first aid packet, though moist gauze is better. If available, a large square of rubber tissue is preferable as it permits air, blood and exudates to flow out of the chest but prevents air from entering. If none of these are available, the wound must be quickly closed with anything available, the man's shirt, an ordinary thread and needle, etc.

Hemorrhage from the lung usually ceases spontaneously. Arterial hemorrhage, however, has to be controlled by ligation. Death usually results promptly if the large vessels of the chest are damaged.

As soon as the patient reaches a place where surgery is available, the wound should be rapidly cleaned and débrided, easily accessible foreign bodies removed and blood sucked from the pleural cavity if possible. Sulfanilamide powder should then be freely scattered in the pleural cavity and the wound sutured tightly. Empyema or lung abscess may develop later. Some of our patients developed fluid in the pleural cavity but no empyema.

Abdomen. Patients having abdominal wounds require early operation or they will develop a fatal peritonitis and must, therefore, be evacuated before all other patients. Too much time should not be wasted trying to overcome shock before evacuation.

Upon arrival at the hospital, if there is doubt of intra-abdominal injury, it is better to do an exploratory laparotomy than to wait until the diagnosis is certain. Use open drop anesthesia unless an expert anesthetist is available. This type of patient does not do well under spinal or intravenous anesthesia.

When operating, excise the wound of entrance, pack with sulfanilamide and enter the abdomen through a separate incision. Remove intraperitoneal fluid by suction or sponging. Examine the entire abdominal cavity rapidly and systematically. Never conclude that the abdominal injury is slight because the wound is small and examine the abdominal viscera thoroughly regardless of location of the external wound. Control bleeding and close multiple bowel perforations transversely to protect the intestinal lumen. Resection should not be done unless the intestinal blood supply is inadequate. Scatter 8 to 10 Gm. of sulfanilamide through the peritoneal cavity and close the wound without drainage. Drainage is rarely indicated and may do more harm than good. None of ours were drained. Sulfonamides are given routinely by mouth for a week or ten days after operation.

A conscientious effort must be made to repair these wounds as recovery often occurs in an apparently hopeless case.

Patients with gunshot wounds of the abdomen, treated as above outlined by the Navy after the raid at Pearl Harbor, showed less than 1 per cent mortality though many patients were not operated upon for some five or six hours after injury. We had one patient who was not operated upon for about eight hours after being wounded and made a good recovery. These patients were all ambulant cases when they arrived on the West Coast eighteen days later.

During the first World War, there was a mortality of from 60 to 80 per cent among patients with gunshot wounds of the abdomen. Recent reports from the Solomon Islands' area, where the treatment above outlined has been used, show a mortality of less than 5 per cent among these cases.

Burns. Approximately 254 cases of burns were admitted to the Naval Hospital, Pearl Harbor. Practically all were flash burns from exploding bombs or torpedoes and preponderantly second degree burns. Some were oil burns.

So-called "flash burns" are burns caused by the very temporary but terrific heat produced by the flash of flame accompanying or immediately following the explosion of aerial bombs and torpedoes. A quite noticeable and very unusual feature of these burns was that those parts of the body surface which were covered by clothing of any kind were not burned. When the attack occurred, many men on board ship were below decks and in various stages of undress. They dashed to their stations without waiting to dress. Some had on trousers and no shirt; some were in their underclothes; some only had on a pair of trunks. Those wearing undershirt and trousers were burned only on the arms and face; those with trousers but no shirts were burned over the entire body above the waist; those wearing only trunks were burned over the entire body except about the hips; those fully clothed were burned only about the hands and face.

There were many first degree and some combined second and third degree burns but no pure third degree types. Burned areas covered as much as about 80 per cent of the body surface. The vast majority of cases were contaminated with fuel oil. Quite a number of patients had been overboard in water heavily coated with fuel oil and were covered with it from head to foot. All were given local treatment, some type of tanning process, as rapidly as possible. The following applications were used: tannic acid spray 5 to 10 per cent; 2 per cent aqueous gentian violet spray; triple dye spray; 10 per cent tannic acid spray followed by silver nitrate 10 per cent; tannic acid jelly; sulfanilamide in mineral oil 0.8 Gm. to 100 cc. Bland ointments were used on hands and face.

Morphine sulphate gr. ½ was administered hypodermically and repeated if necessary. Shock treatment consisting of heat, intravenous plasma, normal saline, or normal saline and 5 per cent glucose was started as rapidly as possible. Teams were organized to give each form of treatment. For the first forty-eight to seventy-two hours, only small amounts of dry plasma were available. Fairly large quantities of normal saline or saline and glucose solutions were given until more plasma became available. These were then supplanted by plasma or used in combination with it.

Because of the great number of burn cases, it was necessary to use anything that was available which would spray the solution. Ordinary flit guns were emptied, refilled with the medicated spray, and used to spray patients.

A large majority of the patients were covered with fuel oil but no attempt could be made to remove the oil or débride patients until the first or second day after admission. Local treatment was, therefore, necessarily applied over the oil. Reasonably efficient tanning nevertheless resulted. Inability to secure early and efficient cleansing of the burned area is the main difference between war burns and burns encountered in civil practice. During an engagement, nothing more than advanced first aid is possible.

As soon as the necessary cradles could be obtained, each severely burned patient was placed under a heat cradle, several blue electric lights being used to supply the heat and the cradles covered with blankets. Blue lights were used because wards had not been previously blacked out and a total blackout was imperative.

This work continued throughout the day and night for about ten days, doctors, nurses and corpsmen working in relays. At night, the only light available in the wards

was the faint blue light given by flashlights equipped with blue glass. This naturally slowed up work seriously, especially intravenous medication.

By the third day, reorganization of patients was accomplished and similar cases gotten into the same ward. Teams of corpsmen were organized and rapidly trained to cleanse patients, débride wounds, do minor dressings and force oral fluids. A number of convalescent patients, seamen, electricians, machinists, etc., who were in the hospital before the air raid joined in this work and did exceedingly well. This is a very good example of what the lay worker, such as nurse's aid, can do on such occasions. Great difficulty, however, continued to be experienced in removing the fuel oil from patients as no suitable detergent could be found. It was later found that the removal of fuel oil could be expedited by the use of a gauze or cotton sponge saturated with mineral oil. This readily removes the thick black oil but also leaves a thinner oily film which may require removal. This latter step is more easily performed.

By the third day also, considerable quantities of human wet plasma had become available to replace the dried plasma which had been on hand prior to the raid, all of which had been used. This wet plasma was presented from the blood bank at Queen's Hospital, Honolulu. Hundreds of citizens volunteered to give blood for this purpose. The wet plasma was invaluable as it filled in the interval between the dried plasma which had been on hand before the raid and additional dried plasma later received by airplane from the mainland.

As more plasma became available, some two-thirds of the medical personnel, assisted by rapidly and specially trained corpsmen, commenced giving plasma to the great majority of patients with burns. At this stage, failure of the tanning treatment was seen on the severely burned patients. There had been such a great loss of fluid through the skin that the eschar had become macerated and in many areas completely rubbed off. In some cases, the loss of fluid was so great that the patient would be found lying in a regular pool of his own fluid.

It must again be remembered that, in addition to the early scarcity of plasma for such a large number of patients, practically all treatment had to be given during the daylight hours. There was no proper provision for a ward blackout for the first week and the only light available was the dim blue light from a flashlight. Because of this very poor night light and extensive burned areas with constricting or collapsing surface vessels, intravenous medication after dark was most difficult but was nevertheless accomplished.

As the eschar was removed, different forms of local treatment were tried: gentian violet spray, sulfanilamide in mineral oil, wet dressings and open exposure under a heat cradle. There was no apparent difference in the results but it was found that almost any kind of dressing that was allowed to dry on the burns defeated its purpose as it would become foul in twenty-four hours and required removal. This removal, besides causing considerable pain, would leave raw, bleeding and infected surfaces.

The fourth and subsequent days, treatment was practically the same. Cleansing the patient in the morning, débridement, further application of local treatment, more and more plasma, and intravenous fluid.

It is well to note here the difficulty of giving intravenous therapy to badly burned patients. The cubital veins could not be seen or felt in many instances because of the great amount of edema, but in spite of the apparent impossibility of finding these veins, we did find them and did for many days give therapy in this way. In only a few cases was it necessary to cut down on the veins and in some that were cut down on, the patients were in such poor condition that you could not get your solution to flow. The femoral vein was the only one we were always certain of finding because everybody wore at least a pair of trunks and this area was not burned. This

vein was used in a number of cases and in a smaller number the jugular vein but in none of these were the veins exposed. With such continuous intravenous therapy over a considerable period of time, conservation of all available veins was most important. As their blood pressure improved, the veins on the feet and ankles became more prominent and were also used.

During the first week following the emergency, our laboratory was practically out of commission as the technicians had been assigned duty in attendance of the very sick patients. When it went back into commission, we endeavored to get an estimation of the kidney function, the red blood cell counts and the serum protein estimation. It was found that although practically all the serious cases showed albumin in their urine, there were comparatively few that showed evidence of any great kidney damage. Approximately three patients passed bloody urine for several days.

The great importance of an early supply of plasma and fluids for patients extensively burned was impressed upon the entire staff. The loss of plasma with consequent blood concentration, serum protein depletion, and reversal of albumin-globulin ratios make replacement essential. It is of the greatest importance to check the patient's hemoglobin concentration. The figure of 115 to 120 per cent requires 250 c.c. of plasma to restore the concentration to normal. In giving plasma to these cases, no reactions were noted following the commercial dried plasma but a number were observed following first use of pooled wet plasma. This was undoubtedly because the first wet plasma supplied was prepared so hurriedly to meet the unprecedented demand that a good deal of the plasma contained red blood cells and fibrin. As the work progressed, the plasma became better and fewer reactions were noted. Wet plasma should be filtered before use in order to remove any fibrin which may be present.

Chemotherapy was used quite extensively after the first two or three days. Some patients developed a temperature which was considered to be due to local infection. These were given 1 Gm. of sulfanilamide every four hours until the temperature had been normal for several days. This form of treatment seemed to be most beneficial. After the fourth or fifth day, sulfanilamide dusting powder was also used on the raw, infected surfaces and kept moist with wet saline dressings. This appeared to do as well, if not better, than anything else available.

After some ten days of intravenous therapy, some patients showed a marked secondary anemia. These were given 500 cc. of whole citrated blood. In a few cases, these transfusions had to be repeated several times.

After the first week, fairly heavy doses of vitamin C and thiamin chloride were given. This was continued until the case was closed. As soon as the patient could eat, a high vitamin, high protein diet was prescribed.

Before giving our statistical report, it is well to point out that while the treatment that has been described may be criticized, we think that under the circumstances, the rapidity of the admissions, the unheard of numbers of severely burned patients being admitted to one hospital in such a short period of time and consequent lack of sufficient plasma, the results would compare favorably with any other type or types of treatment even though prepared for it, for any type of elaborate ideal treatment would have to be abandoned under such circumstances.

Of the 254 burned patients admitted, approximately thirty-eight died within the first thirty-six hours and of these thirty-eight, twenty-seven died within the first twelve hours.

	Per Cent
The percentage of death to total admissions.....	27.5
Corrected for those that died in first 12 hours...	16.7
Corrected for those that died in first 36 hours...	12.5

Of the 216 patients who were alive after the first thirty-six hours, there were approximately ninety in a serious condition, with from 40 to 70 per cent of the total skin surface burned to a second or third degree. Of these ninety cases there were twenty-seven deaths, or 30 per cent.

We know that this mortality rate of 30 per cent seems to be high but it must be remembered that all of these ninety patients were seriously and very extensively burned, that comparatively little plasma was available for the first forty-eight to seventy-two hours and that they were all admitted within twelve hours. If the admissions had covered a period of several days, it is thought that this mortality could have been reduced by 50 per cent, but it is also thought that even with ideal therapy, there will always be a mortality of 15 to 20 per cent in severely burned cases.

An estimate of the amount of plasma that we would have needed for ideal plasma therapy is as follows:

First 24 hours—360 units of 250 cc. each or 90,000 cc.
Second 24 hours—270 units of 250 cc. each or 67,500 cc.
Next four days—270 units of 250 cc. each or 67,500 cc.
Next seven days—270 units of 250 cc. each or 67,500 cc.
or a grand total of 1170 units.

These figures are considered to be minimum.

Some of our patients ultimately received a total of 8,000 to 11,000 cc. of plasma.

Before the raid, both the Army and Navy thought that they had sufficient dried plasma on hand. I had 500 units. But we had no conception of the enormous number of severely burned patients we would be called upon to treat nor the tremendous amount of plasma that would be required. In estimating the amount of plasma that you should have immediately available at a hospital in an area exposed to enemy air raids, estimate the amount you think you will need, add what you consider an adequate reserve, and then multiply that by three; then you will have about what you really need.

There have been several formulas given to be followed in the administration of plasma. These are based on the hematocrit reading and the plasma protein level. One of the doctors at Honolulu said after December 7, 1941, that if he had a big plasma bank and a good bookkeeper, he could follow these formulas. During or just after an air raid attack or in the field and on board a ship in action, however, one either cannot obtain or must distrust these readings. I would like to say that I have not yet seen a report in medical literature of death attributable to an overdose of plasma.

The Bureau of Medicine and Surgery, Navy Department, has issued some very simple practical instructions for the administration of plasma in cases of severe burns. These are as follows:

a. May be administered before any laboratory work is done.
b. Always give in divided doses.
c. Amount required during first twenty-four hours:
   (1) 10 per cent of surface burned, 1,000 cc.
   (2) 20 per cent of surface burned, 2,000 cc., and so on.
d. If possible, do hematocrit determination. For each point above 50 per cent cells, give 100 cc. of plasma.
e. Always give intravenously.
f. Repeat as indicated.

Some time after the air raid, we received a small amount of the recently developed solution for local treatment of burns, triethyldiazine or 2½ per cent solution of sulfadiazine in 8 per cent triethanolamine. It is applied as a spray. This had been widely heralded but was not immediately available to us locally. A great opportunity for comparative study was missed but the future may offer it again. We did, however, later use it on two burned patients and our observations are given for your information.

These patients had only 5 to 10 per cent of the body surface burned and that only to a first and second degree. The results obtained were very satisfactory. After a pre-

liminary careful cleansing and débridement of the burned areas, the sulfadiazine solution was sprayed on, every hour for two days and thereafter every two or three hours as necessary. After the first two days, a nice semitranslucent film was formed over the burned surface. This film remained on until the burned surface was healed. There were only one or two small areas that showed any evidence of infection and by cutting a window at this site and spraying hourly for a day or two, the infection was controlled.

In our opinion, some of the advantages of this sulfadiazine solution for local treatment of burns are: (1) A nice, clean, semitranslucent, pliable film is formed covering the burned area so that it can be seen through and the condition of the burned surface followed; (2) apparent relief of pain; (3) resistance to local infection; (4) apparent prevention of loss of fluids; and (5) it may be used about the face or genitalia and does not cause constriction of fingers or joints.

Some of the disadvantages are: (1) The extreme care necessary to cleanse and débride the burned area takes considerable time; (2) the time required for the necessary repeated sprayings before the film is formed over the burned area. In our opinion, this is an excellent treatment for burns but these disadvantages will probably prevent this treatment from being used where there are any considerable number of patients with extensive burned surfaces.

SUMMARY OF LATEST INFORMATION ON TREATMENT OF WOUNDS AND BURNS

At this point, a summary of the latest information on the prevention of infection in wounds and the treatment of burns as recommended by the National Research Council is given:

"Sulfanilamide is the drug of choice for local or parenteral therapy and sulfadiazine for oral therapy.

"(a) Locally, crystalline sulfanilamide is preferable to the powdered drug but the latter should be used if the crystalline form is not available.

"When used locally, sulfathiazole tends to cake, may act as a foreign body and obstructs drainage of wound secretions.

"(b) Parenterally. A 1 per cent solution of sulfanilamide in sterile physiological saline solution may be given, usually under the fascia on lateral side of thigh, 150 cc. every six hours for four to seven days after operation.

"This solution should be boiled for 5 minutes to sterilize and then cooled to 37°C.

"Dry sulfanilamide, crystalline or powdered, should be sterilized before use by exposure to dry heat for a period of 2 hours at a temperature of 156°F.

"A 5 per cent solution of sodium sulfadiazine may also be used. It is not to be sterilized. The initial dosage is 0.1 Gm. per kilo of body weight. Subsequently, .03 Gm. per kilo of body weight may be given every 12 hours for 4 days.

"Sulfathiazole and sulfapyridine may also be given in 5 per cent solution intravenously but not subcutaneously.

"(c) Orally. Two Gm. of sodium sulfadiazine should be taken in one dose orally, immediately after the wound is received. Following this, 1.0 Gm. should be given every 6 hours. In order to maintain a proper blood level of the drug, it should be given around the clock. This treatment should be continued for 7 days at which time, if the wound is clean and there is absence of fever attributable to infection, oral therapy should be discontinued. If the wound is infected, treatment should be continued as indicated.

"For penetrating or through and through wounds, prepare a suspension of sulfanilamide crystals in sterile physiological saline solution. Sulfanilamide solubility varies greatly, from .75 Gm. in 100 cc. at 25°C. to 47. Gm. in 100 cc. at 100°C. Such a suspension of the crystals can be used as a means of introducing sulfanilamide into deep wounds.

"The suspension should be made up at the time of use and the syringe containing it should be rotated while it is being introduced into the wound in order to maintain the suspension.

"When gauze drains or wicks are used, moisten them in sterile saline solution and dip in crystalline sulfanilamide before being introduced into the wound.

"After any wound is redressed, it should be 'frosted' with crystalline sulfanilamide at each dressing until healed."

Our first aid packets now contain a small amount of crystalline sulfanilamide to be dusted on a wound by an injured man. They also contain 1 Gm. tablets of sulfadiazine with instructions for taking same, commencing promptly after being wounded.

It has been stated that sodium sulfadiazine may only be used intravenously and not intramuscularly or subcutaneously because it is highly alkaline and may cause a slough. Five per cent solution of sodium sulfadiazine has, however, been frequently used at the Children's Hospital, New York City, by Dr. Gilbert M. Jorgenson and others without a slough resulting. It appears that the statement that sodium sulfadiazine could not be used subcutaneously because of its high alkalinity is based on a misconception of the buffering or neutralizing effect of tissue fluids upon sodium salts of the sulfonamides. While sodium sulfadiazine is highly alkaline in a bottle or test tube, in practice it does not act "highly alkaline" nor cause a slough when used intramuscularly or subcutaneously.

Neither powdered sulfathiazole or sulfadiazine are satisfactory as local treatment for wounds. Sulfathiazole, especially, cakes and prevents drainage of wound secretions. Fox and Rose, at the College of Physicians and Surgeons, New York, have shown, however, that sodium sulfadiazine is as good or better than sulfanilamide locally. Considerably less is required and large amounts do not produce the complications possible with excessive use of sulfanilamide.

BURNS

The recommended treatment of burns continues in a state of flux, as has been the case for years.

Burns of the hands, face and genitalia should be treated by application of an aqueous emulsion of 5 per cent sulfadiazine. If this is not available, use boric acid ointment or other similar preparation. Cover burned areas with fine mesh gauze, 44 mesh per inch if available. Firm bandage and cotton waste should be applied to hands. Do not bandage face or genitalia.

The tannic acid method of treatment for burns of the trunk, arms and legs is losing ground in Great Britain and this country, the chief reasons being the locking in of infection, difficulty in removal of eschar under these conditions, interference with skin grafting in third degree burns as a result of loss of vital epithelium from action of the tannic acid, and the possible hazard of liver damage incident to the toxic action of the coagulant.

An important addition to the treatment of burns is an ointment recently developed by Dr. Charles L. Fox, Jr., of the College of Physicians and Surgeons, New York. This ointment has an anhydrous base and contains 5 per cent tannic acid and 2.7 per cent sodium sulfadiazine. This is alkaline and has a hydrogen ion concentration of 7.5. In 1932, Stanley J. Seeger wrote of the high degree of edema produced in tissues by solutions in the acid ranges and stated that the best results are obtained at the hydrogen ion concentration nearest 7.4. The hydrogen ion concentration of the water soluble 10 per cent tannic acid, 5 per cent sulfadiazine jelly used in treatment of burns is 2.55. The 7.5 hydrogen ion concentration of Fox's jelly is very near the ideal of 7.4 as stated by Seeger.

Use of Fox's jelly is still somewhat in the experimental stage in that there have not been sufficient severely burned patients in this vicinity to treat with it. I have seen it used, however, on a number of severely burned experimental rabbits and personally

I like its action much better than either the tannic acid-silver nitrate spray or the 10 per cent tannic acid, 5 per cent sulfadiazine jelly. Fox's jelly produces a rather thin, quite pliable and soft but firm eschar over the burn. This is not adherent but moves freely over the underlying tissue. The burned area is dry, there being no edema nor oozing or weeping of serum. Removal of small sections of the eschar showed a clean healing surface beneath. The eschar was sufficiently tough to resist removal and none had been rubbed off by the rabbits. The sulfadiazine controls infection.

I have been informed that the Subcommittee on Burns of the National Research Council was impressed with the results of Dr. Fox's preparation and voted at its last meeting to recommend discontinuing the use of tannic acid jelly for the first aid treatment of burns, since it was believed that there was little opportunity for proper débridement in the field and consequent danger of infection. It is presumed that the Committee will go on record in favor of some other technic in the near future.

After Pearl Harbor, we used different methods of treatment in different wards where burns were treated. Our observations showed that there was little, if any, difference between them. One day, the patients in one ward looked better and the next day, those in another ward seemed the best.

The majority of our staff preferred the tannic acid-silver nitrate spray. In this, a freshly prepared 10 per cent tannic acid solution is sprayed over the entire burned area, followed immediately by spraying with a solution containing equal parts of 10 per cent tannic acid and 10 per cent silver nitrate. This last solution is applied every half hour for four applications.

With infected burns, however, after they have been cleaned with normal saline, the local application of crystalline or powdered sulfanilamide kept moist with warm normal saline compresses renewed every three or four hours gave excellent results. It is recommended that not more than 15 Gm. of sulfanilamide be applied in any one twenty-four period.

Sulfadiazine spray will also clear up an infection but requires frequent spraying and is impractical for mass casualties. Powdered sodium sulfadiazine locally controls infected burns promptly. Fox's jelly will also clean them. Various sulfonamide impregnated "films" have been manufactured for use on burns. While these are full of possibilities, those known to me have not been successful in controlling infection in burns, apparently because of an insufficient sulfonamide content. Fox's jelly has successfully controlled these infections. Examination of exudate from beneath the eschar of infected burns at the College of Physicians and Surgeons has shown 130 mg. per cent of sulfadiazine in patients treated with this jelly and none in patients treated with other preparations.

An extremely interesting new light on the treatment of burns has recently been reported. This is that burns of patients whose ships had been sunk and who had been overboard for several hours before being rescued, were in appreciably better condition than burns of patients who had not been overboard. The highly salt seawater is quite bactericidal and had a definitely beneficial effect upon the burns. The saline content of sea water is a little more than three times that of normal saline solution.

Many extensively burned patients are now treated with hypertonic (double strength) saline solution locally and excellent results obtained. The burned area is loosely covered with a single or double thickness of gauze, frequently only tossed on like a fluff, and the saline solution sprayed on frequently so that the area is kept moist. Once and sometimes twice a day, circumstances permitting, the burned area is given a tub bath or soak of a half hour or an hour in the hypertonic saline solution.

In case of an infected burn, sulfanilamide or sodium sulfadiazine may be used locally with the hypertonic saline solution as

previously described with normal saline solution.

For removal of fuel oil from burned areas, any one of three detergents obtainable commercially are recommended. These are Dreft, Drene and Orvus. All are used in 5 per cent solution.

With all severe burns, 500 cc. of blood plasma should be given at the first aid or casualty clearing station if possible before evacuation to the hospital.

Concentrated human serum albumin may be used in place of blood plasma. If used, 100 cc. is equivalent to 500 cc. of plasma. It is given intravenously.

When physiological glucose and saline solution are given to burned patients, the amount given should not exceed the amount of plasma given in twenty-four hours, except in those instances in which there is severe hemoconcentration—a hematrocrit reading of about 70 per cent cells.

BLAST INJURY OR CONCUSSION OF THE LUNG

These cases, while not very numerous, were extremely interesting. Nineteen were admitted between December 7 and 11, 1941. Twelve were mild cases and were returned to duty in from five to seven days. Three were moderately severe but were returned to duty in from seven to ten days. Four cases were severe.

All of these patients exhibited varying degrees of severity and differing combinations of the following symptoms: shock, restlessness, labored breathing with diminished air intake, cough, cyanosis and blood streaked or frothy sputum. All had been in the vicinity of high explosive blasts and, in addition, many had inhaled dense oil smoke for considerable periods. Because of this fact, these cases were at first considered to be smoke inhalations but later, because of the symptoms and clinical course, considered with the situational etiologic agent (blast from high explosive), were diagnosed as blast injuries to the lungs as described by various military observers in England and Europe. The four severely ill patients had a clinical course not unlike lipoid pneumonia.

The outstanding lesion of this condition is pulmonary hemorrhage resulting from the impact on the body wall of the positive pressure wave created by the detonation of high explosives. This wave has a velocity of about ninety miles a minute. There is rupture of the pulmonary capillaries and alveolar walls and the air sacs are filled with red blood cells. There may also be subarachnoid hemorrhage.

Marked restlessness and excitement is a prominent symptom while the shock is out of all proportion to the apparent degree of injury. The physical symptoms vary greatly but limited respiratory excursion, with limited air intake and coarse or sibilant râles throughout the lungs are the usual findings. *X*-ray examination shows a characteristic mottling, poorly demarcated areas of increased density scattered throughout both lungs, somewhat resembling a patchy pneumonic consolidation or miliary tuberculosis. The severity of the injury and, therefore, of the symptoms, is directly proportional to the distance between the individual and the explosion.

That this condition may cause almost immediate death is shown by the fact that some twenty casualties found to be dead upon arrival at hospital had no external evidence of injury other than a bloody froth about the lips. Some six others who died within a few hours after admission had no external evidence of violence. No autopsies could be performed on these cases because of the great pressure of work in caring for the living.

Review of the literature on this subject shows that the sound waves of the pitch that predominates in explosions of large bombs may be as long as thirty feet and of considerable amplitude. Pressures up to 200 atmospheres or about 1⅓ tons per square inch have been observed in the compression part of the wave. In 1940, Zuckerman proved that a sudden elevation of pressure, retarding the expulsion of air from the trachea and forcibly compressing

the body walls, could rupture the delicate pulmonary tissues.

Early recognition of this injury should be emphasized because the patients are at first not likely to be considered seriously ill and because of the value of early rest and oxygen therapy. Several of our patients would have died without oxygen.

Treatment of these cases was chiefly symptomatic, viz: morphine sulphate and codeine for restlessness and cough; oxygen for respiratory difficulty and cyanosis; forced fluids and strict bed rest.

COLLATERAL ACTIVITIES

A very important part of our staff was the Chinese galley force. Midday on December 7th, they worked until 3:00 P.M. cooking and serving dinner to 4,500 persons. They then immediately started getting supper ready. Not only the hospital staff but all defense personnel in the vicinity of the hospital were fed by us. A renewal of the Jap attack that afternoon or night had to be anticipated and it was imperative that our defenses not be weakened by men going any great distance for meals.

An extremely important part of our work on December 7th and for several days afterward was identification of the dead. The hospital acted as a clearing house in this respect, all bodies being brought there for identification prior to burial. We prepared lists of dead and the detail having this duty worked twenty-four hours a day for several days in order that the lists might be sent to the Navy Department as soon as possible.

SUMMARY

What happened at the Naval Hospital at Pearl Harbor, may happen to any hospital anywhere in an area exposed to air raids. It used to be said in Pearl Harbor, "It can't happen here." But it did happen there and it can also happen in New York.

A well organized, smoothly running team is as important in efficiently caring for war wounds as it is in scoring touchdowns on the football field.

The wounds produced in an aerial attack must all be regarded as serious because wounds produced by aerial bombs are usually multiple and almost invariably very severe. While competent surgical treatment is required as soon as possible, remember that surgery cannot be done under these circumstances or in the field as it would be done under conditions in civil life. Our first object is to save life (1) by controlling hemorrhage, (2) by allaying shock, and (3) by every possible effort to prevent infection.

Competent surgical treatment may be promptly available or it may not be available for several days. Local use of sulfanilamide in wounds has removed the old bugbear of military surgeons, the development of infection in the wound. The development of dried blood plasma now permits the administration of plasma on board ship and in the field, thus saving many lives which would previously have been lost.

In the field, casualties may be grouped in three classes: (1) Those killed outright or so seriously wounded that they die within a short time. When there are many casualties, little time should be given these hopeless cases. (2) The slightly wounded who will recover regardless of the type of emergency treatment. Most of these can be rapidly treated and returned to duty. (3) Those with more serious wounds who have a good chance of recovering providing adequate treatment is available. The lives of many of these patients rest entirely in the hands of the man doing the emergency dressing and it is what he does or fails to do that frequently makes the difference between life and death.

A large percentage of the patients with wounds of the head and trunk die on the field. About three-fourths of all casualties received in hospitals have wounds of the extremities.

Emergency treatment of external hemorrhage is generally understood by all.

Laymen should be especially cautioned concerning use of the tourniquet, however, as it can be extremely dangerous. Applied too long at a time, gangrene results; applied too tightly, it causes a great deal of tissue damage and acute symptoms of shock may develop when it is released. The tourniquet should not be used until all other methods have failed.

The treatment of shock should start before its onset. Waiting for the clinical picture of shock to develop before instituting treatment invites disaster.

The best field preventive of shock is blood plasma. The powdered plasma can be easily prepared for use by the addition of distilled water and need not be warmed prior to injection. Plasma should be given all seriously wounded patients as soon after injury as possible, certainly immediately after receipt at the first casualty clearing station. Transfusions of plasma within this zone will do more to reduce mortality from shock than any other single factor. All members of field medical units should thoroughly understand the administration of dried plasma.

Evacuation of the wounded is frequently a difficult problem in the field and considerable judgment must be exercised in picking out the urgent cases for primary evacuation. Ordinarily, patients with abdominal wounds should be evacuated first, then those with head wounds, chest wounds and wounds of the extremities.

It is most important to label patients conspicuously or mark them on the skin before evacuation to hospital so that the next person treating them will know when a tourniquet was applied, when morphine was given and dose, etc.

Some confusion will inevitably exist in the best of hospitals, prepared or unprepared, upon receipt of such an avalanche of patients as may be expected following an air raid. The following points are suggested to remember in connection with handling a large number of war wounded, unexpected or otherwise.

Hospitals properly prepared for casualties should have ample supplies of material readily available—many times the amount needed for normal times. Until you actually experience it, you simply cannot realize how rapidly supplies of all kinds, surgical dressings especially, disappear, for the wounds are frequently multiple and often of great size.

Patients should be admitted to the hospital at but one entry if at all practicable, so that their injuries can be quickly examined and their disposition made without unnecessary delay. It is also important that certain wards or groups of wards be designated for treatment of certain classes of casualties: acute surgical, fractures, burns, etc., and equipped accordingly.

If practicable, one doctor should rapidly examine casualties on admission, tag them in accordance with the nature of their injury and send them to their proper place in the hospital.

This job is really very important and should be filled by a surgeon of wide experience and sound surgical judgment. He should have adequately trained assistants. Casualties may have multiple injuries and a large wound may not be nearly as serious as one difficult to discover.

All injured patients on entering hospital fall into one of five categories: (1) Those needing treatment for shock; (2) those in need of minor surgical assistance; (3) those needing major surgery immediately; (4) those needing surgery later or not at all, and (5) those beyond surgical assistance.

The admitting doctor should quickly but accurately survey the casualty and write on his forehead in mercurochrome the number indicating into which of these categories the patient falls.

It is also desirable, if practicable, that the patient be tagged at this time with a card giving his name and previous medication. Actually, this cannot be done in practice if a flood of casualties is arriving as was the case with us at Pearl Harbor. We started to tag our casualties upon arrival

but it took too much time and we quickly stopped it.

It is quite desirable to detail a surgical consultant to go about the wards and designate patients for transfer to the operating room in accordance with the condition of the patient and the availability of operating space. It is better for patients to await surgery in their wards than to clog approaches to operating rooms.

When possible, it is best not to remove the patient from the stretcher, on which he is placed when first picked up, until he is finally deposited in his ward bed. This lessens possible shock. Immediately necessary treatment for shock may easily be given with the patient on a stretcher. Major operations can also be performed with the patient on a stretcher.

We followed this procedure to a considerable extent at Pearl Harbor, the ambulance drivers being given other stretchers to replace those under patients in order that they might immediately return for more casualties. This scheme of course required many stretchers but we had a good many on hand and our carpenter shop rapidly made more.

If any large number of injured is to be cared for, it is important that a special ward or wards be designated for the treatment of shock, that its staff be especially competent to administer such treatment and that it be adequately equipped with ample apparatus for this purpose. Wards for burned patients should be similarly specially equipped for burn therapy. We were considerably handicapped by an inadequate amount of these supplies immediately available. Once again, we had not anticipated such a flood of patients as we received. Valuable time was lost in obtaining necessary additional equipment from the storeroom. Our immediately available supply of stands to support infusion apparatus gave out and the carpenter shop had to make extemporaneous stands rapidly. But although we had to struggle and extemporize, the patients nevertheless got their needed treatment with reasonable promptness and no harm was done.

The importance of the Orr-Trueta plaster cast treatment for extensive wounds of the extremities was emphasized at the Naval Hospital, Pearl Harbor, and in evacuation of patients to the mainland. This treatment was used considerably in the late war in Spain and by the English in the present war. After Dunkirk especially, the English stated that wounded soldiers treated by this plaster cast method before evacuation reached England in much better condition than similar cases in the last war. Local use of sulfanilamide on the wound before applying the plaster has brought even better results. Plaster immobilization of extremities after severe wounds with or without fracture very definitely relieves pain and promotes healing. With this treatment, patients can be transported in comparative comfort while their wounds improve instead of possibly becoming worse.

An excellent substitute for a plaster splint in the field is a papier-mache splint which I was recently shown. This splint dates from the closing days of the last war, when a French countess, working in a Casualty Clearing Station, heard French Army doctors talking of the number of cases of serious compound fractures who developed severe shock and other complications as a result of careless and badly handled splinting by Ambulance Corps and First-Air parties.

An inexpensive, readily transported splint, easily and quickly applied, was needed and, with the aid of sketches supplied by doctors, the Frenchwoman evolved this paper splint.

At the beginning of this war, the French Air Force demanded a light splint that supplied rigidity and immobilization for temporary splinting of badly injured aviators. Upon hearing of this need, the daughter of the inventor communicated with the War Office and, after official investigation and tests, the paper splint was adopted by the Ministry of War.

The British became interested in these splints and started making them. Some were very successfully used in the Norway campaign. One patient had his fractured leg in one of these splints four days before he finally arrived at a hospital. Upon arrival there, both leg and fracture were in good condition.

These splints are made for compound or simple fractures of the long bones, and for right and left arms and legs. A metal or heavy cardboard mold is made of proper dimensions and contour to fit a limb. The splint itself has a base of light cardboard such as cigarette cartons, or heaviest quality Manila paper. This base is cut the shape of the mold and soaked in water for a half hour. It is then fitted in the mold and allowed to dry.

After drying, the molded splint base is covered on both sides by irregularly torn pieces of waste paper about four inches square, overlapping each other about ¾ of an inch. The pieces of paper are pasted on the splint base, a thin coating of paperhanger's paste being commonly used. The edges of the splint are similarly covered with pieces of paper.

Tapes, usually selvedge edges discarded in bandage making, are placed around the outside of the splint, under the outer paper covering. For arm splints, they are placed three inches from each end. With leg splints, a third tape is placed around the middle. The ends of these tapes are brought out through the outer paper layer, about 3 inches from the edge. This permits overlapping of the edges of the splint if necessary.

When thoroughly dried, each side of the splint is given a single coating of spar varnish or shellac in order to make it waterproof and impervious to the elements.

Traction splints for the leg may be made by including a narrow lath bolted to each side under the outer paper layer. These extend about 6 inches beyond the foot of the splint and the ends are connected by a small cross bar to take the traction. Countertraction is obtained by the upper end of the splint which fits the upper thigh, lying posteriorly in the fold of the buttock.

These splints are exceedingly cheap, can be made anywhere, and require no critical materials nor ship transportation. A half dozen can be nested in each other and fastened under the top of an ambulance for use when needed. They may be padded with clothing, grass or anything available. They are purposely made large to allow for swelling of the limb. They have the advantages of a plaster splint without the disadvantages, being light yet strong and giving complete immobilization without danger to fractures. They are very difficult to distort or destroy and are absolutely safe in the hands of inexperienced persons. They may be used for large wounds or burns of the extremities as well as for fractures.

One of the most important lessons learned at Pearl Harbor was the imperative necessity for hospitals or any medical activity in areas subject to enemy air attack to provide themselves with large stocks of reserve medical supplies, sterile gauze, shell dressings, etc., and to scatter these in several of the most widely separated and best protected rooms or spaces available. The necessity for these things is of course readily apparent—to prevent loss of all medical supplies or all main operating facilities by one direct hit. One of my chief worries at Pearl Harbor was my operating pavilion that stuck out like a sore thumb. I was constantly worried less some Jap should take it into his head to drop a bomb through it. I was most unhappy about possible future raids until I had three complete operating rooms established, one at each end and one in the middle of the basement of the hospital where they were sufficiently protected by reinforced concrete and sand bags to stand at least one direct hit.

A very important detail is to simplify technic as much as possible. This is essential for handling mass casualties. Streamline your technic. Since December, 1941, I have seen hospitals which were organized for possible air raids but whose burn teams

were trained to carry out an elaborate technic that would inevitably break down in the presence of such a flood of seriously burned casualties as we received during the air raid at Pearl Harbor. Remember that in the treatment of masses of war burns, the same principles must apply that apply to other classes of wounds. The immediate treatment can only be advanced first aid—administration of morphine, treatment of shock and prevention of infection. Administration of plasma to severely burned patients must be started with the least possible delay. Local treatment, cleansing, débridement, local applications, are of course all desirable and important but they require considerable time and can wait. The immediately imperative necessity is treatment of shock. Local treatment can be carried on at the same time or as soon afterward as practicable.

In closing I would like to say a word about my hospital staff at Pearl Harbor at the time of the raid. I was proud of them all and especially proud of my nurses and hospital corpsmen, many of whom were youngsters who had been in the service a comparatively short time. They stood their baptism of fire well. When the Jap planes roared over and around us, they dashed from their quarters to the main hospital building through a shower of anti-aircraft shell fragments and stray machine gun bullets. Their first thought was to care for their patients and to get ready for those we knew would soon be coming. Though occasional shell fragments and machine gun bullets zipped through our temporary ward buildings, everybody was so busy that they had no time to think of themselves and fortunately nobody was injured. After the raid, all hands worked until they dropped, the nurses especially. I will always remember my chief nurse, a frail appearing little woman who looked as though a good gust of wind would blow her away. But she was made of steel wire. She was everywhere, encouraging, supervising, directing. Three days after the raid, it was necessary to order her to go to bed and get some sleep.

At midnight of December 7th, we had 960 patients in a hospital whose official rating was 506 patients. The next day we received almost a hundred more who had been temporarily cared for at outlying activities.

The hospital staff took great pride in the fact that, though understaffed for such a great number of serious casualties, we had anticipated our needs and were able to care for our own in this emergency without any outside medical assistance except some volunteer trained nurses from Honolulu.

The Naval Hospital, Pearl Harbor, was given the unusual distinction of being cited by the Commander in Chief, United States Pacific Fleet, for distinguished services during and subsequent to the Japanese attack on December 7, 1941.

The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

MELANOMA

A REVIEW OF THIRTY-TWO CASES ADMITTED TO THE BROOKLYN CANCER INSTITUTE DURING A FIVE-YEAR PERIOD

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MELANOMA can be defined as a malignant tumor derived from pigment producing cells. Naevosarcoma, melanosarcoma, malignant naevus and naevocarcinoma are other terms used to describe this lesion. Naevus or mole, on the other hand, represent a benign process; they are congenital and are closely associated with the melanomas both from their gross and microscopic appearance. The term naevus is used interchangeably and may be used to designate a pigmented mole, a hemangioma (a vascular lesion) or a lymphangioma (a lymphoblastic tumor).

RELATIONSHIP OF PIGMENTED MOLES TO MELANOMAS

Fifty-four per cent of the skin melanomas to be reviewed gave a history of having had a pigmented mole at the site of the lesion "all of my life." This is in agreement with other observers, as Pack and Livingston,[1] who found that "more than fifty per cent of melanomas develop in naevi which have been present since birth or shortly thereafter."

Some investigators consider the common mole a precancerous lesion which may be activated by injury, irritation, inflammation or endocrine stimulation, whereas others subscribe to a modified Cohnheim theory, believing that a melanoma starts as a "quiescent" new growth which consists of congenitally misplaced and potentially malignant cells. These cells may suddenly become activated and develop all the characteristics of a malignant growth due to some unknown factor, intrinsic or extrinsic.

When a pigmented lesion increases in size, changes color, ulcerates, crusts, oozes, bleeds, becomes elevated, itches, pains or exhibits any detectable variation from its usual appearance, malignant activation is to be suspected.

MICROSCOPIC CHARACTERISTICS

Melanin is produced by specialized cells called melanoblasts. These melanoblasts may be demonstrated as early as the fifth month of fetal life by the "dopa" reaction of Block.[2] The color of a pigmented lesion depends on the location and quantity of melanin present. If it is predominantly epidermal or at the epidermodermal junction, the color is brown; if it is deeper down in the cutis or subcutis it may be blue-black in color. Hemociterin granules are commonly present in these lesions and are difficult to differentiate from melanin. (Fig. 1.)

Microscopically, a mole consists of closely packed collections of clear rounded or polyhedral cells in the dermis, usually at the epidermodermal junction. These clear cells are the so-called "naevus cells." Melanoblasts are fusiform cells often filled with pigment, they are apt to be grouped around these so-called naevus cells.

Melanomas have the general microscopic characteristics of other malignancies. Boyd[3] points out that "no tumor presents a more varied picture than the melanoma, and it is not too much to say that it may simulate a carcinoma, sarcoma, endothelioma and even lymphosarcoma." The amount of pigmentation varies markedly. With the absence of pigment, the diagnosis has to be made from the cytological picture alone.

The following theories as to the origin of the melanotic cell are presented: (1) It may arise from some epithelial source. According to Ewing,[4] this was first broached by Unne, 1893, and is still attested to by more modern workers. (2) It may arise from the perithelium or endothelium of blood vessels. Demiaville, 1880, (Ewing). (3) It may arise from certain fibroblastic or mesoblastic cells, as the chromatophore. (Ribbert.[5]) (4) It may arise from the nerve cells within the sensory nerve organs, as Meisner's corpuscles and the tactile end organs of Merkel-Ranvier. (Masson.[6]) This latter possibility, i.e., origin of the naevus cell from nerve-end organs is at present widely accepted.

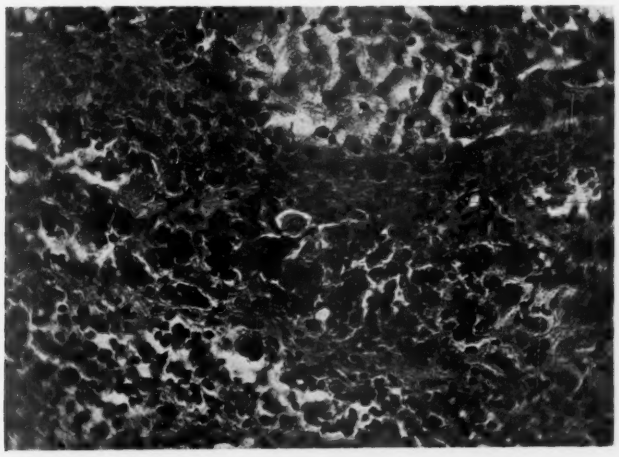


Fig. 1. Microphotograph of a malignant melanoma.

HEREDITARY AND RACIAL FACTORS

Pack[1] has shown that the average individual is born with fifteen to twenty pigmented moles. Their almost universal presence in the skin of all people of the white race would rule out any hereditary familial characteristic.

Melanomas are rare in the North American Negro. According to Baxter,[7] the relative incidence of occurrence of melanoma in the black and white race is as one to four.

REVIEW OF CASES SEEN AT THE BROOKLYN CANCER INSTITUTE

Thirty-two cases of melanoma were admitted to the Brooklyn Cancer Institute from January, 1936, to March, 1942. They comprise 1.2 per cent of all cases and 11.5 per cent of all skin lesions hospitalized in that period. No negroes were among this group.

The average age was 52.4 years. There were seven cases under forty-four years of age. The youngest patient was twenty-two and the oldest eighty years. This age incidence agrees with the findings of other workers. Darier (Cholnoky[8]) states that the average age of various collected cases presented in the literature varies from forty-seven to fifty-five years.

Fig. 2. M. B. Primary melanoma of heel in a thirty-nine year old white female. A mole had been present since birth.

Many observers believe the relatively low incidence of malignancy of these lesions

during infancy and childhood is due to an endocrine factor. The sex hormones, which are most active after puberty, are known to

Fig. 3. W. S. These extensive skin metastases were so radioresistant that although sufficient radon was implanted at the base of some of the nodules to cause them to slough, the tumor recurred rapidly in the necrotic base.

influence pigment production. It is of interest to note in this regard the case report of Parkes Weber,[9] who describes a case of melanoma transmitted from mother to fetus via the placenta with death of both.

Eighteen (56 per cent) of the thirty-two patients were female and fourteen (44 per cent) were males. This agrees with the sex incidence as reported by Taussig and Torrey,[10] who found an almost equal distribution between the sexes, while Pack and Livingston[1] found a slightly higher per cent of males (55 per cent vs. 45 per cent).

ANATOMIC DISTRIBUTION

In our series the distribution of the primary lesion was found to be:

	No. of Cases
1. Skin	
Extremities	
Lower	9
Upper	5
Face	4
Neck	1
Trunk	6
2. Miscellaneous	
Eye (choroid)	6
Rectum	1

From these figures it is shown that 29 per cent occurred on the lower extremities and 16 per cent or only half as many on the upper extremities; whereas it is an established fact that pigmented moles are more frequently present on the upper extremities.

Melanomas of the choroid comprised 19 per cent of our cases, the second most frequent primary site. The warning symptom of intra-ocular melanoma is blurred vision or decreased visual acuity. Pain and proptosis are usually late manifestations.

Most of the other lesions were present on the exposed portions of the body and of necessity subject to trauma. One third of the cases reported in this series gave a history of single or multiple injuries to a so-called pigmented mole.

These neoplasms tend to remain dormant for years and after growth is established the individual can often remember some injury. These so-called injuries are apt to be bizarre in character, as for instance, one woman who had had a small black mole on her forearm. A chicken pecked at the mole and shortly after this incident "it started to grow." The activation is frequently ascribed to abrasions and other minor injuries. There are times, however, when the severity of the injury and the time relationship of activitation is more convincing as to cause and affect. For instance, one young adult male had his foot severely crushed by a heavy roll of newsprint paper. This was followed a month later by growth in a so-called pigmented mole on the dorsum of his foot. On careful

consideration the location of the lesion on the dorsum of the foot would make it subject to repeated pressure and chafing from a shoe over the course of years. If the severe contusion was a factor, it could only be the culmination of a series of lesser insults to this so-called quiescent melanoma.

FIG. 4. M. H., a fifty-five year old white female, had a lytic and expansile clavicular metastasis secondary to melanoma of the sole of the foot.

FIG. 5. W. S., a forty-nine year old white male, had skin metastases from a primary melanoma of the sole of the foot. Several minor procedures were done before a biopsy was taken.

SPREAD

A melanoma seldom results in serious disturbance due to local growth. The danger lies in its metastases. The usual spread is (a) by direct extension into the surrounding tissue, (b) by the lymphatics to the adjacent skin and regional lymph nodes and (c) by the blood stream to distant parts (lung and liver). Blood stream dissemination usually occurs late in the disease.

In this series clinically demonstrable regional node metastases were found to occur on an average of 19.2 months after

development of activity in the primary lesion. In some cases, such as melanoma of the rectum and choroid, region node, metastases were not clinically demonstrable because of anatomic reasons.

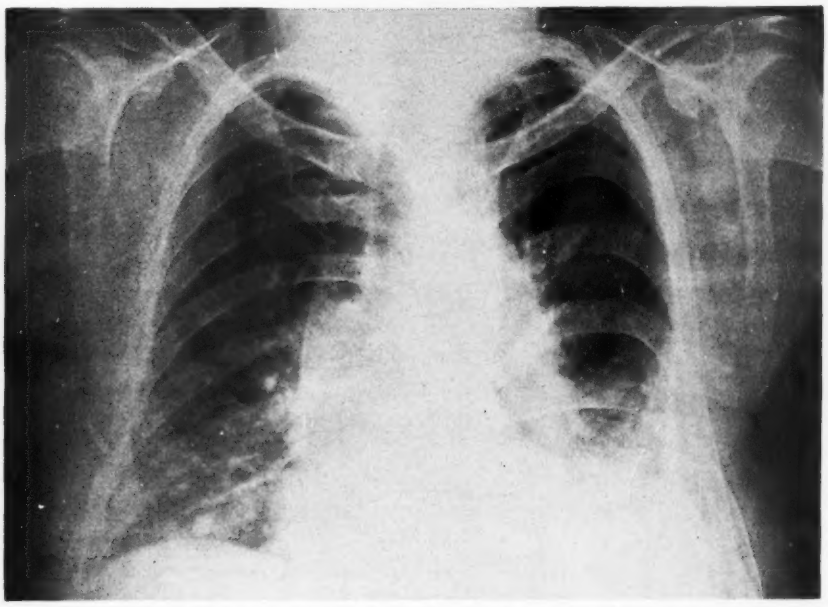


FIG. 6. J. R., a fifty-seven year old white male, had pulmonary metastases from a primary melanoma of the choroid seven and one-half years after exenteration.

Twenty of the thirty-two cases developed regional node metastases. These metastases were demonstrated in the following sequence of time:

Months	3 to 12	12 to 24	25 to 72
Number of cases	7	9	4

The shortest time interval was in the case of a young man who developed femoral metastases three months after noticing enlargement of a pigmented mole of his calf. The longest interval was that of a sixty-eight year old female who developed metastases some six years after a melanoma was removed from her upper eyelid.

Regional nodes were the first to be involved, except in three instances: two cases in which skin nodules (skin lymphatics) appeared first, and a third case in which the metastases were first discovered in the lung. (Fig. 6.)

DISTANT METASTASES

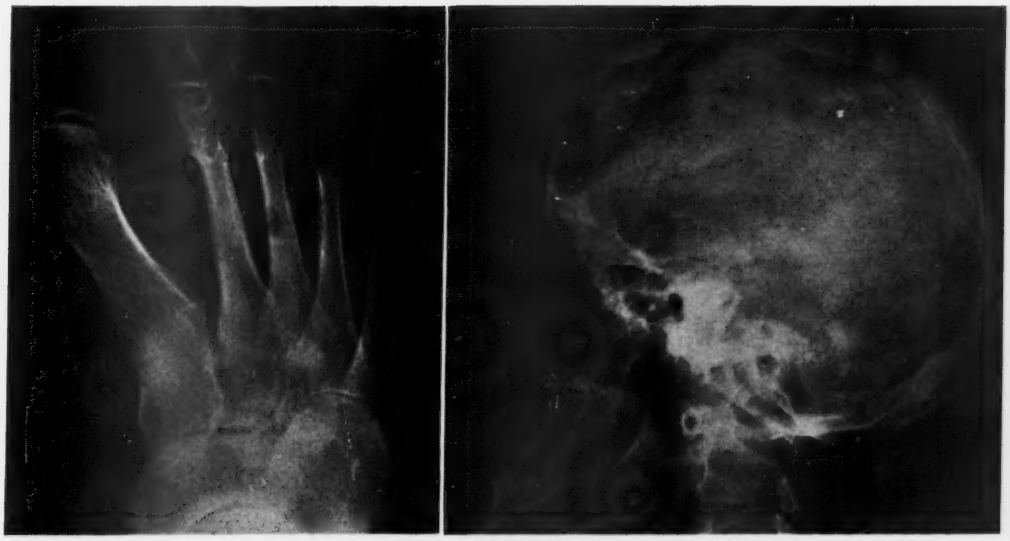
The following is a list of the distant metastases in the order of their frequency

Location of Metastases	No. of Cases	Per Cent
Pulmonary	8	25.0
Liver	5	15.6
Bone	6	18.6
Cerebral	3	9.6
Abdominal peritoneum	1	3.1
Pelvic peritoneum	1	3.1
Retroperitoneal nodes	1	3.1
Tongue	1	3.1

Distant metastases tended to appear after an average time interval of two years and eight months. The earliest manifested metastases, pulmonary and hepatic, were one case to each of these organs within eight months. The average length of time it took for the four most frequent distant metastases to occur was: liver, 19.4 months; pulmonary, 35.4 months; skull, 50 months; cerebral, 51 months.

Bone metastases in this group were considerably higher than in other reported series, some of which range as low as 1 per

A



B C

FIG. 7. S. P. A, multiple rarefying metastases in a forty-nine year old white female; primary melanoma of the rectum; B, metastasis in the third metatarsal bone—an unusual location; C, multiple skull metastases in the same patient.

cent. Six patients or 18 per cent of this series developed bone metastases. The following bones were involved:

Skull	4	
Ribs	2	
Pelvis, Vertebrae, Clavicle, Scapula, Metatarsus, Femur	each 1	In 3 cases the metastases to bone was multiple and in 3 cases the bone lesion single.

The roentgenographic appearance is in no way characteristic. The bone lesions were uniformly lytic in character, round or oval in shape, having a clean smooth edge without evidence of cortical or periosteal reaction zone. The cortical bone is entirely resorbed within the lesion. (Fig. 7*A*.) Only in one case was there an expansile lesion. (Fig. 4.) Here there was mushrooming out of the head of the clavicle to about twice its normal diameter and with pathological fracture through this expanded shell.

TREATMENT

The table rather dramatically demonstrates the inadequacy of dealing with a melanoma by single or multiple local excisions. There is not a single survival in this group, while with a more radical excision seven out of ten have survived, averaging over five years. It is appreciated that many successful local removals may be performed and that unless there is recurrence the case may never be referred to a Cancer Hospital.

It is the authors' opinion that the routine dissection of the lymphatic drainage areas from a week to two weeks after radical excision of the primary growth, as recommended by Pack and Livingston,[1] represents a real forward step in the treatment of this condition. The demonstration of naevocarcinoma cells within the dissected lymph glands and the improved results as reported by these authors is proof of the efficacy of this procedure.

Eleven patients had local or radical excision or multiple excision followed by regional lymph node dissection. These patients, however, would not fit in with the procedure as outlined by Pack,[1] in that none of these dissections were done until there was clinical evidence of spread to the lymph nodes. Only one patient had the secondary operation in a month's interval and this case had both local and glandular spread at the time of the second operation. The average interval between the excision of the tumor and the dissection of the lymphatic drainage area was more than one year for the four cases who survived. It is immediately suggested that in these particular cases, the growth was slow and the metastatic spread delayed.

Several of these patients received radiation therapy. This therapy was applied to distant metastases in cases in which surgery could no longer be considered of palliative or curative value. As a rule these lesions are much more radioresistant than the usual squamous cell carcinoma. Irradiation of a melanoma when it can be surgically removed only adds to the difficulties of surgery if decided upon later.

SUMMARY

Melanoma is defined as a malignant tumor of pigment producing cells. Its relationship to the benign naevus is discussed. The microscopic appearance and different theories as to origin of melanotic cells are outlined. Racial and hereditary characteristics are discussed.

Thirty-two cases of melanoma entered at the Brooklyn Cancer Institute in the five-year interval between 1936 and 1942 are reviewed and results summarized. From these records it appears that this tumor most frequently metastasizes first to the regional lymph nodes. This spread may occur after an interval of from three months to six years. The most frequent site of distant metastasis was found to be lung, liver and bone. The latent period before the development of distant metastases was two years eight months.

The best results were obtained in this series by radical local removal. The authors, however, agree that this should be followed whenever possible by regional

lymph node dissection as recommended by Pack.[1] Radiation therapy is discouraged except for treatment from a palliative angle.

STATISTICAL TABLE OF ALL CASES REVIEWED—COMPARING METHOD OF TREATMENT AS AGAINST SURVIVAL

Method of Treatment	Number of Cases	Living			Expired		
		Alive	Survival Following Clinical Onset of Activity	Survival Following Surgical Intervention	Dead	Duration of Life Following Clinical Onset of Activity	Duration of Life Following Surgical Intervention
1. Single local excision	6	0	.....	.....	6	2 yrs. 2 mos.	2 yrs.
2. Multiple local procedures	7	0	.....	.....	5	2 yrs. 6 mos.	1 yr. 5 mos.
3. Radical excision C	11	8	5 yrs.	3 yrs. 6 mos.	3	4 yrs.	3 yr. 6 mos.
4. Local excision or radical excision delayed regional lymph node dissection	10	4	3 yrs.	2 yrs. 6 mos.	6	2 yrs. 9 mos.	2 yr. 6 mos.

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BILIARY TRACT SURGERY

SURVEY IN SALT LAKE CITY HOSPITALS 1930 TO 1940 INCLUSIVE

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THIS paper represents a survey of biliary tract surgery in the four general hospitals of Salt Lake City for the period extending from January 1, 1938, to December 31, 1940, inclusive. This survey was conceived with the idea that such a study might prove of interest and value since it differs from most studies of biliary tract surgery in several important particulars. Most such studies come from large clinics, hospitals or groups in which the work is done by a few highly trained surgeons under ideal or nearly ideal and uniform conditions. This study on the other hand represents the work of a comparatively large group of surgeons (seventy-seven) of variable training and experience, no doubt using variable technics not only in the operation itself but also in the preoperative preparation and postoperative care. It represents 411 operations on 401 patients. The great majority of these patients are private cases although in the Salt Lake General Hospital all were charity cases and in the other hospitals there was a small percentage of charity patients in each.

TABLE 1

Total number of patients	401
Total number of operations	411
Total number of deaths	29
Death rate per patient	7.2%
Death rate per operation	7.05%
Number of surgeons	77

This study is not intended to reflect on or to give undue credit to the skill, judgment or surgical ability of these men and the hospitals. It was undertaken as a purely scientific study with their co-operation and support and for this I am indebted to them.

Table 1 represents the types of operation in this study, the number of each and their attendant mortality. It will be seen that the entire group represents a mortality rate of 7.2 per cent per patient and 7.05 per cent per operation. In contrast to this Lahey[1] reports 2,346 cases with a mortality rate of 3.8 per cent; Walters[2,3] 1.8 per cent mortality in 930 cases (1938); 2.8 per cent (1939) in 1,179 patients; Goldman[4] 2.5 per cent (435 cases), etc. (Table IV.)

Age. The ages of the patients in this group varied from nineteen to eighty years and the average for the entire group was 48.2 years. There was just one patient under the age of twenty (19) and twenty others under the age of thirty years. None of the group under the age of thirty died, and of these twenty-one patients twelve had gallstones and of these one had acute cholecystitis, the others having chronic cholecystitis except one which had acute cholecystitis without stones. Sixteen patients had cholecystostomy done and only five had cholecystectomies.

Sex. There were eighty-seven males and 314 females or a ratio of 21 per cent males and 79 per cent females. This is in line with other published reports although many series give a higher proportion of males than is present in this series. Walters reports the ratio of females to males is about 2½ or 3 to 1.

Incidence of Stones. Of the 411 patients operated upon 288 were found to have stones either in the gallbladder or the ducts or both; 113 did not have stones. The proportion of stoneless cases in this series is high compared with most reported series. In contrast to these figures of 70 per cent of cases having stones and 30 per cent of stoneless cases, Lahey[1] reports 2,346 cases of which 95 per cent had stones in the gall-

bladder or the ducts, Walters[2] reports approximately 90 per cent with stones and 10 per cent without stones, and in Whipple's[5] series the proportion is 80 per cent and 20 per cent etc. (Table VI.)

Pathology. Eighty-nine patients of this series had acute cholecystitis, an incidence of 21.6 per cent. This compares with an incidence of 14.3 per cent in Heyd's series' 5.9 per cent in Walter's[2,3] series of 1939 and 5.4 per cent in 1940; 12.2 per cent in Goldman and Bell's[4] series and 6.6 per cent in that of Whipple's.[4] Of these eighty-nine cases thirty-eight had clinical evidence of acute inflammation of the gallbladder as evidenced by fever and leucocytosis as well as a pathologic diagnosis of acute cholecystitis. Twenty-eight had a pathological diagnosis of acute cholecystitis but no fever or leucocytosis. Twenty-three had clinical evidence of acute inflammation of the organ with fever and leucocytosis but there was no tissue removed at operation from which a pathologic diagnosis could be obtained. This latter group in most cases had an operative note to the effect that there was acute inflammation, empyema, perforation, etc. Of these eighty-nine patients, twelve died, a mortality rate of 13.4 per cent. There were three cases of carcinoma of the gallbladder and in two of these a cholecystectomy was done and in one a cholecystostomy. There were 313 cases of chronic and subacute cholecystitis, an incidence of 76.1 per cent. There were two cases of papillomas of the gallbladder and one case of carcinoma of the liver. (Case in which cholecystgastrostomy was odne; patient died.)

Table II

Type of Operations	Number	Percentage	Deaths	Mortality, Per Cent
Cholecystectomies	301	73.2	12	3.98
Cholecystostomies	61	14.8	9	14.7
Cholecystectomies and choledochostomy	33	8.0	4	12.1
Cholecystostomies and choledochostomy	5	1.2	1	20
Plastic operation on common duct	3	0.7	1	33⅓
Choledochostomies	2	.4	1	50
Cholecystduodenostomies	1	.2	0	0
Cholecystgastrostomies	1	.2	1	100
Exploration and lysis of adhesions	4	.9	0	
	411		29	

Table III

Number of patients having stones	288
Number of patients not having stones	113
	401
Average age	48.2
Sex	
Male	87
Female	314
	401
Acute Cholecystitis	
Diagnosed clinically but no pathological specimen	23
Diagnosed pathologically	28
Diagnosed pathologically and clinically	38
	89

Type of Operation. There were 301 cholecystectomies in the 411 operations, an incidence of 73.2 per cent, sixty-one cholecystostomies (14.8 per cent), thirty-three cholecystectomies with choledochostomy (8.0 per cent), five cholecystostomies with choledochostomy (1.2 per cent), choledochostomy alone in two or .4 per cent, three plastic operations on the common duct (0.7 per cent), one cholecystduodenostomy, one cholecystgastrostomy, and four cases of exploration with lysis of adhesions around the gallbladder. The incidence of cholecystectomy and cholecystostomy in this series corresponds quite closely with the incidence of these procedures in other series. In the listing the first figure indicates the percentage of cholecystectomy and in the second the incidence of cholecystostomy: Heyd's[6] 61 and 1 per cent; Goldman and Bell's[4] 78 and 13.7 per cent; Walter's[2,3] 79 and 5 per cent; Bachhuber's[7] 71.2 and 1.6 per cent; Evans and Evert's[8] 11.9 per cent; Haggard et al.[9] 78 and 10.3 per cent;

Whipple's[5] 62.7 and 3.4 per cent; Allen's[10] 56 and 6.2 per cent, etc. (Table IV.)

Common Duct Exploration. The indications for exploration of the common duct have been much discussed in recent years and there is some disagreement among various writers regarding them. For example Glenn[11] gives the following indications: (1) Palpable stones; (2) history of progressive jaundice or repeated attacks of jaundice; (3) a dilated common duct. If the common duct is indurated with acute or subacute inflammation of the gallbladder with only mild jaundice (an icteric index of 30 or less) the common duct is not opened. Crile (quoted by Eiss[12]) gives the following indications: (1) History of chills, pain and fever; (2) dilatation of the common duct; (3) jaundice, not otherwise accounted for; (4) palpable stones. Cutler and Zollinger (quoted by Heyd[13]) give the following indications: (1) Suggestion of stones on palpation; (2) dilated or thickened common duct; (3) a contracted gallbladder; (4) a dilated cystic duct; (5) thickened head of pancreas; (6) presence of small stones in the gallbladder or cystic duct. Lahey[14] gives the following indications: (1) Jaundice past or present; (2) thickened or contracted gallbladder; (3) dilated duct; (4) palpable stones; (5) thickened head of pancreas; (6) character of bile, if murky or deeply clouded the common duct should be opened. Walters[3] says that the common duct should be opened if: (1) The duct is enlarged; (2) if there is a palpable stone; (3) if there is a history of jaundice, chills and fever; (4) cases of recurrent intractable symptoms following biliary surgery.

TABLE IV

Author	Ectomy		Ostomy		C.D. Explor.		All Cases	
	No.	Mortality, Per Cent	No.	Mortality, Per Cent	No.	Mortality, Per Cent	No.	Mortality, Per Cent
Cheever[16]	260	0.8	...	.....	166	4.8	452	4.1
Bachhuber[7]	566	6.4	67	11.9	64	20.3	630	8.41 (Excludes secondary ops. and tumors)
Grey Turner[15]	790	3.55	(Ect. and ostomy)		220	13.18	1040	5.86
Haggard and Kirtley[9]	749	6.6	(Ect. and ostomy)		86	10.4	841	7.3
Boyd[17]	412	11.2	39	30	43	11.5	1018	10.5
Whipple[5]	527	1.1	29	6.1	162	26.5	840	
Allen[10]	1183	2.45	130	12.3	775	4.25	2088	3.73 (Excludes cancer and bile duct injury)
Heyd[6]	2438	3.61	43	30.24	296	16.5	3986	7.7
Heyd[13]	428	7.47	45	28.8	98	14.2		
Lahey[1]	....	.....	...	.....	...	.....	2346	3.8
Glenn[11]	....	.....	...	.....	112	12.5		
Walters[2]	....	.....	...	.....	...	.....	930	1.8
Walters[3]	1018	1.8	65	10.8	364	3.		
Goldman[4]	343	1.7	6	0	86	5.8	...	(No plastic cases)
This series	301	3.98	61	14.7	40	15	411	7.05

Although these indications vary somewhat, they agree fairly well on three indications, namely, (1) the presence of palpable stones, (2) a dilated common duct, (3) a history of jaundice.

The operative notes and histories in this series of cases were carefully examined in an effort to determine how many of them should have had the common duct explored. Incompleteness of hospital records made this impossible with any degree of

accuracy. In very few operative reports was anything said about the size or induration of the common duct, or of the size of the stones in the gallbladder. The records on jaundice, however, were probably fairly accurate since most histories and physical examinations had a statement regarding the presence or absence of jaundice, past or present. A study, therefore, was made using a history of jaundice as the only criterion, to see in how many of these cases the common duct was explored, also to determine in how many of these latter cases stones were found, and in how many cases there was jaundice either at the time of operation or in the past and to see how frequently the common duct was explored as compared with other series. It was found that of the 411 cases, eighty-nine gave a definite history of jaundice at some time and of these twenty had their common duct explored. Nineteen gave a history of slight or doubtful jaundice past or present and of these five had their common duct explored. There were twenty-five others who had definite jaundice at the time of operation or slight or doubtful jaundice, but no history of it in the past and of these, eighteen had their common duct opened. This makes a total of forty-three who had their common duct opened and excluding three cases who had plastic procedures on the common duct, this leaves only forty cases, an incidence of 9.7 per cent in which the common duct was opened. This compares with Goldman's[4] series 19.8 per cent, Lahey's[1] 45 per cent, Walter's[2,3] 22, 19 and 24 per cent, Grey Turner[15] 21 per cent, Whipple's[5] 19 per cent and Allen's[10] 37 per cent incidence of choledochostomy. That absence of jaundice, past or present, does not indicate absence of stones in the common duct is shown by Lahey[14] who found that 40 per cent of those cases in which stones were found in the common duct had no history of jaundice.

TABLE V

Author	No. of Cases	Ect. Alone		Ost. Alone		Ect. and Doch.		Ost. and Doch.		Doch. Alone		Plastic, Etc.	
		No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Heyd	3,986	2,438	61	43	1	238	5.9	16	0.4	37	0.4	5	0.1
Goldman and Bell	435	343	78	6	13.7	(86 with ect. or ost.)			19.7				
Walters	1,289	1,014	79	65	5	(327 C.D. opened) (364 oper. on C.D.)			25.4				
Bachhuber	630	499	72.2	67	10.6	(64 cases C.D. opened)			10.1				
Evans and Everts	....	....	86	...	11.9	9.4—C.D. opened							
Haggard, etc	841	662	78	87	10.3	(C.D. opened in 86)			10.29				
Whipple	840	527	62.7	29	3.4	(162 had C.D. opened)			19				
Allen	2,088	1,183	56	130	6.2	775	37						

It is of interest further to study the mortality rate of the common duct explorations in this series and to compare them with others. There were forty cases in which the common duct was explored. The mortality for the group was 15 per cent. This series is small but the rate is high when compared with those of some writers. Cheever,[16] for example, reported 166 cases with a mortality of 4.8 per cent, Allen[10] 775 cases with 4.25 per cent mortality, Walters[2] 364 cases with 3 per cent mortality and

Goldman[4] eighty-six cases with 5.8 per cent. On the other hand there are many who report a higher mortality than is found in this series. Bachhuber[7] (L. A. General Hosp.) reports sixty-four cases with 20.3 per cent mortality, Whipple[5] (Presbyterian Hospital) 162 cases with 26.5 per cent mortality, Heyd[6] 296 and 16.5 per cent, etc. Walters reports that in his experience a choledochlithotomy can be done with little more risk than a primary cholecystectomy. Lahey[14] states that in experienced hands exploration of the ducts does not add to the risk and diminishes mortality and morbidity. He explores the ducts in 40 to 50 per cent of his cases and finds stones in 16 to 20 per cent of the total or nearly half of those in which he opens the duct. He also reports that about 4 per cent of cases have stones in the common duct but not in the gallbladder and Heyd[6] found the same situation in 6 per cent. In the hands of operators in this series, exploration of the common duct added considerably to the operative mortality.

TABLE VI

	Percentage of Cases with C.D. Opened	C.D. Explorations and Stones Found in Common Duct
Lahey	45%	18% of total cases
Glenn	112 of 907—12.1%	60 of 122—59.8% of cases of C.D. opened
Heyd	392 of 3,986—9%	No. of stones (?) doesn't say
Walters	186 of 850 (1937)—22%	Stones in 88% of 186—47.3%
	174 of 930 (1938)—19%	Stones in 78% of 174—47.8%
	254 of 1,079 (1940)—24%	Stones in 149—58%
Goldman	86 of 4,443—19.8%	Stones in 10.9%
Heyd	7.7%	Stones in 6.9% or 28% of C.D. opened
Evans and Everts	9.4%	
Grey Turner	220 of 1,040—21%	
Haggard, etc	86 of 841—10.2%	
Whipple	162 of 840—19%	
Allen	775 of 2088—37%	

Comment. There may be some disagreement concerning the indications for exploration of the common duct. I am sure, ever, that all will agree that jaundice, past or present, constitutes one indication. Using this one indication as a criterion, it is obvious that in this series common duct exploration was not carried out nearly as often as should have been done. There may be and undoubtedly are many surgeons who do not share Lahey's opinion that the common duct should be opened in 40 to 50 per cent of the cases. Certainly it has been the experience of many surgeons of large experience that common duct exploration has been necessary in much smaller percentage of cases and these men claim that the incidence of bad results such as the necessity of secondary operation for stones missed is low.

The advisability of such a high rate of common duct exploration also seems somewhat questionable in view of Goldman's findings that injury to the common duct is apparently increasing. In spite of all this it appears certain that the common duct was opened in too small a percentage of cases in this series (less than 10 per cent). On the other hand the high mortality of this procedure in this series would seem partially to justify this tendency to shy away from the common duct by many surgeons. In considering these facts and figures one cannot help but arrive at the conclusion that common duct surgery (and we must necessarily include gallbladder surgery in general since one cannot know beforehand which cases will need the common duct explored) should be done only by well trained experienced surgeons.

SUMMARY

This paper reports on a series of surgical cases involving the biliary tract operated upon in the four general hospitals of Salt Lake City in 1940.

There were a total of 411 operations of 401 patients carried out by seventy-seven different surgeons.

The mortality rate for the group was rather high, being 7.2 per cent per patient and 7.05 per cent per operation.

The common duct was explored in only 9.7 per cent of cases (excluding three cases of plastic operation of the duct). This is low according to present indications. The mortality rate for this group, however, was quite high (15 per cent).

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BLOOD VESSEL SUTURE

ITS USE INSTEAD OF THE LIGATURE IN WAR SURGERY

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MATAS must be accredited with having first stressed the importance of the preservation and careful approximation of the edges of the endothelium during vascular repair. This was emphasized in his description of aneurismorrhaphy in 1888. Fifteen years later Carrel stimulated renewed interest in vascular surgery by his brilliant animal research which led to the successful development of blood transfusion and the simplified technic of blood vessel suture.

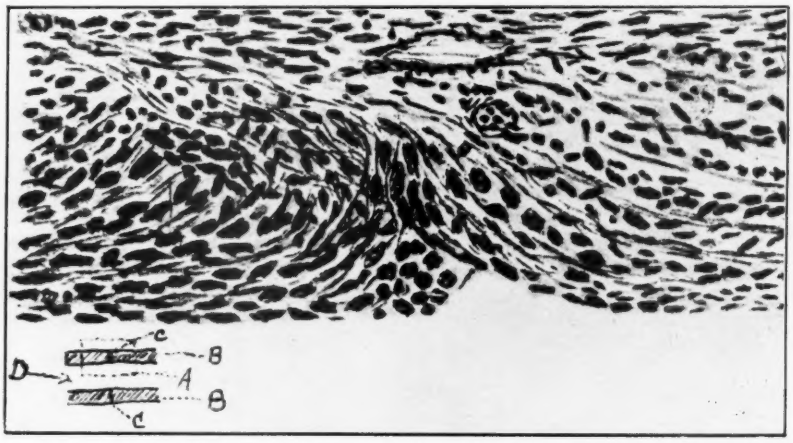

FIG. 1. End-to-end suture of carotids. Dog No. 108. Surg. Path. No. 3846. Operation January 20, 1916. Specimen removed February 9, 1916. Cicatricial tissue firmly unites one vessel end to that of the other. One extremity is slightly everted and the other is implanted upon it. The recess is so obliterated by connective tissue that the intimal lining is completely regenerated. The suture line is hardly discernible on account of the merging of the cicatrix with the sutured ends. Smooth muscle cells as demonstrated in a Van Gieson stain infiltrate the cicatrix. (Goodman, Charles. *Ann. Surg.*, July, 1917.)

In 1913, a symposium on the subject of blood vessel suture was held during the session of the International Medical Congress in London. At that session I had reported my technic for arteriovenous anastomosis in fifteen consecutive cases.

In November, 1917, while overseas with the Presbyterian Hospital Unit (B.E.F. France) and assigned to a Casualty Clearing Station in the Ypres district, I found that ligature was the accepted method for the treatment of blood vessel injuries. It was recognized that ligature of the popliteal or posterior tibial artery was almost invariably followed by gangrene, but apparently no one in the British Service had attempted suture in the treatment of such wounds at the Casualty Clearing Station. At that time I used the Carrel suture in five cases on the popliteal vessels. In these cases the restoration of the continuity of the vessels resulted in tibial pulsation, and gangrene was averted. The following is a brief report of two of these cases:

CASE 1. On November 10, 1917, Private M. C. K. G., age twenty-eight, was brought in with the hamstring muscles badly lacerated. The popliteal vessels were exposed and the

artery and vein were found lacerated. Bleeding was temporarily controlled by the use of flexible clamps, and a longitudinal opening measuring in the popliteal artery just below Hunter's canal with loss of an oval segment of the wall of the vessel. The opening was closed by suture

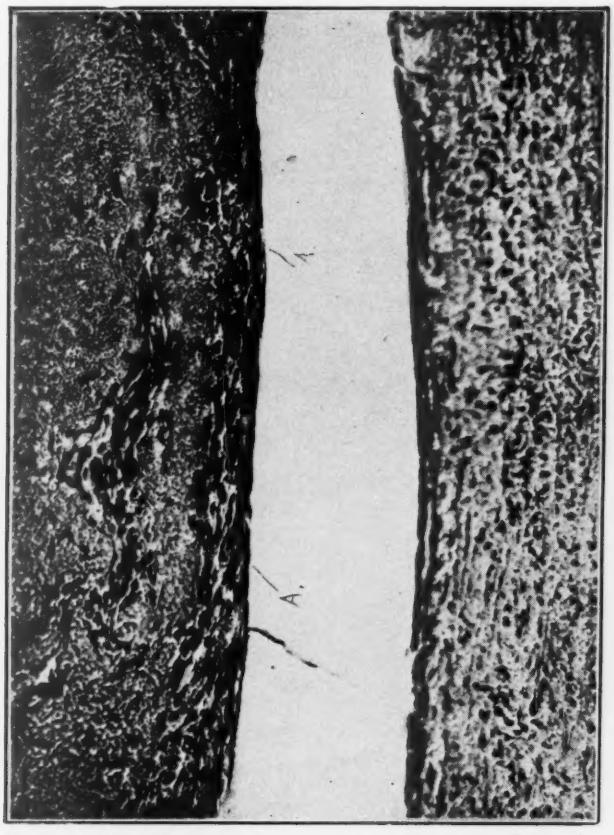

Fig. 2. Microphotograph, mag. 415. Autotransplantation of vein into carotid. Surg. Path. No. 2283. Operation January 3. Specimen removed January 17. Vessel partially occluded by coagulum. Surface of coagulum presents connective tissue cells and apparently no accretion has taken place. Blood coagulum covered by growing fibroblasts also infiltrating coagulum. No further tendency for blood to form a clot in the coagulum which presents a smooth surface as shown here. (Goodman, Charles. *Ann. Surg.*, July, 1917.)

5 mm. in the wall of each of these vessels was repaired with a continuous silk suture. A flap of muscle was reflected over the line of suture for protection, and a Carrel-Dakin dressing applied. Forty-eight hours after the operation the foot was warm, the dorsalis pedis artery perceptible and pulsations normal. Eight days later the dorsalis pedis and posterior tibial arteries were pulsating vigorously; his temperature and pulse were normal and the soldier was transferred to the Base Hospital.

Case II. On November 25, 1917, a private, age twenty-one, was admitted with a through-and-through shell wound of the left thigh. A large oval opening 1¼ cm. in length was found and the caliber of the lumen was reduced to about one-half its normal size. A branch of the femoral vein was ligated. Following débridement of the wound, the suture line in the vessel was covered with a flap of fascia lata to protect it from erosion by the Carrel-Dakin tubes. The circulation of the limb was satisfactorily restored and he was transferred to the Base Hospital. Seventeen days later the soldier wrote me that he had no pain and was making excellent progress.

Subsequently, a few French surgeons employed early suture of blood vessel injuries in war wounds.

In reviewing the treatment of blood vessel injuries at the ambulance Chirurgicale under the command of Proust, the

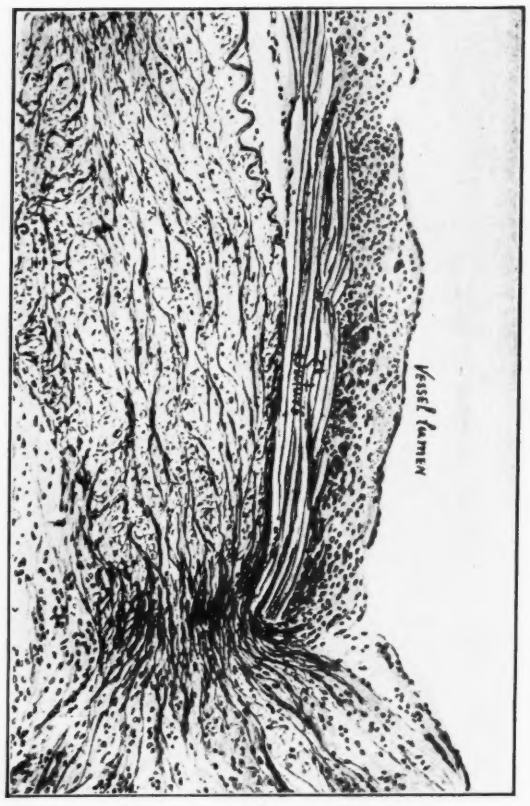

FIG. 3. End-to-end suture of carotid. Dog. no. 27. Surg. Path. No. 3729. Operation, November 13, 1915. Specimen removed November 22, 1915. Sutured ends separated by ½ mm. of connective tissue on one side; on the other side by 2 mm. This connective tissue at some points is dense; at other points it is loosely constructed. The intima regenerates everywhere. At one point, one of the sutures lies within the vessel lumen, and is completely covered by connective tissue with an endothelial surface. Where there was wide separation of the vessel ends, there is a considerable mass of relatively loose connective tissue on the surface which is covered with intima. In the depths the repaired vessel wall is dense and suggests osteoid structures. In the depths of the suture line at another point, very definite osteoid structure exists. There is a distinct dilatation of the lumen present at the site of the suture line. (Goodman, Charles. *Ann. Surg.*, July, 1917.)

French Surgeon, Maurier, notes that he successfully sutured the popliteal artery in two cases. Learmonth, the Edinburgh surgeon, stated in his demonstration, that suture is the ideal method of repairing wounds of blood vessels and restoring their continuity. He adds "hitherto it has had a limited application in military surgery."

During the first World War a number of surgeons of the Central Powers stressed the importance of early suture of blood vessels in the treatment of war wounds. Before the end of the war Von Haberer had reported 200 cases of blood vessel injuries treated by this method, with only one failure. Recently, he again advocated suture as the best method for repair of blood vessel injuries.

On the basis of experiences in the first World War and in civilian practice, I want to emphasize the fact that suture of the blood vessels should have a wider application in war surgery. Despite extensive lacerations resulting from the missiles of war, repair of the arteries of the extremities can be advantageously undertaken in the advanced operating centers. Most of the wounded arrive at such centers within twenty-four hours—a time most favorable for repair of the damaged blood vessels. The wounds may be contaminated but the infection has not yet become invasive. Elaborate instruments are not required for blood vessel suture. The simple equipment can easily be kept in readiness at the advanced operating centers. Fine straight cambric needles (Kirby 16) threaded with fine silk are employed; flexible blood vessel clamps are best for the temporary control of the injured vessels but other devices may be used. The threaded needles are sterilized in mineral oil. These should be kept on hand ready for immediate use. A needle holder is not an absolute necessity. I have adopted an epilating forceps as a convenient instrument for guiding the needle when working in a narrow field. The threaded silk sutures are wound loosely about a small square of cardboard to keep them from becoming snarled.

In the treatment of war wounds with injured vessels, débridement with the removal of all damaged and necrotic tissues should be completed before the repair of the injured vessels is undertaken. Where the vessel is deeply situated, ligation of one

or two of its branches will render the vessel more accessible. The injured vessel is elevated to the surface on two pieces of tape and these may be used for the control of the circulation above and below the laceration. If flexible blood vessel clamps are not at hand, rubber bands or smooth forceps without teeth tied with a ligature may be substituted. A small rubber bulb or piston syringe with saline or Ringer's solution is used to wash away the clot presented at the opening. The adventitia or outer coat of the vessel is then trimmed away about the edges of the wound with the aid of small forceps and scissors. Adventitia contains considerable thrombokinase or ferment. Should the adventitia be included in the suture it may invite thrombosis. The segment between the temporary clamps or tape ligatures is perfused thoroughly with saline or Ringer's solution followed by a few drops of vaseline or mineral oil. The mineral oil keeps the vessel from drying. The rent in the vessel is then closed with a simple overhand suture. With the suture completed, the temporary compression clamps or tapes are removed and gentle pressure applied with a pledget of gauze dipped in mineral oil. Slight oozing may prevail for a few seconds. Should there be a spurt of blood because of the unevenness of the suture, an additional suture introduced

Fig. 4. Microphotograph, mag. 200. Autotransplantation of jugular to carotid, two weeks. Dog No. 201. Surg. Path. No. 2340. Specimen removed January 31, 1913. Walls of the vessels are separated by about one millimeter. The interval is filled in by dense connective tissue. Scar tissue is somewhat irregular but not covered by fibrin, except at one point. A uniform and regular layer of cells covers the cicatricial scar tissue. (Goodman, Charles. *Ann. Surg.*, July, 1917.)

Fig. 5. Microphotograph, mag. 415. Autotransplantation of jugular to carotid; two weeks. Dog No. 201. Surg. Path. No. 2340. Operation January 31, 1913. Walls of the vessels are separated by about 1 millimeter. The interval is filled in by dense connective tissue. Scar tissue is somewhat irregular but not covered by fibrin except at one point. A uniform and regular layer of cells covers the cicatricial scar tissue. (Goodman, Charles. *Ann. Surg.*, July 1917.)

and tied at the point of hemorrhage will effectively control the spurt. The walling off of the operating field with pieces of black silk or other material will maintain a field free from contamination and will render the fine silk sutures discernible, and simplify the procedure. Where a large artery has been completely severed, the ends may be found curled up and retracted. After the wound is débrided, the ends of the severed arteries are exposed and the adventitia overhanging the severed ends of the vessel is removed readily by pulling the adventitia over the end and snipping it off with one stroke of the scissors. This leaves the media and intima exposed for the suture. Three guide sutures are introduced, uniting the two severed ends. I have observed during my personal experience, that approximation of the severed ends by three guide sutures will usually be followed by relaxation. This overcomes the tendency to retraction of the segments, and the circular suture may then be completed without any appreciable difficulty.

FIG. 6. Microphotograph, mag. 100. Arteriovenous anastomosis (human vessels). Surg. Path. No. 3550. The artery in close apposition with vein, especially the adventitia and media. Mass of connective tissue which has grown beneath the intima reinforces the junction. In the section at points the endothelium is intact. A thin layer of fibrin with a few round cells in it is in the venous portion of the section. (Goodman, Charles. *Ann. Surg.*, July, 1917.)

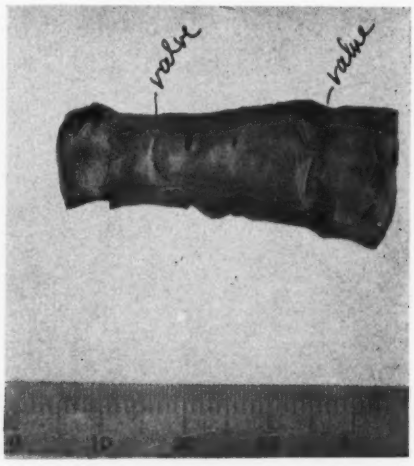

FIG. 7. Homotransplantation of femoral vein to jugular vein. Surg. Path. No. 2477. Operation April 11, 1913. Specimen removed April 18, 1913. Shows two valves in transplanted vein, one of which encroaches upon suture line; no thrombosis. (Goodman, Charles. *Ann. Surg.*, July, 1917.)

The technic of the circular suture is identical with the Connel end-to-end intestinal anastomosis. The only difference observed is that instead of inverting the edges to favor a peritoneal adhesion, in the vascular suture, the edges are slightly everted so that the adhesive properties of the endothelium may be taken advantage of.

In the first World War, most of the wounds requiring blood vessel repair were treated by Dakinization, but with the modern use of sulfanilamide, the postoperative care of these wounds will be greatly simplified and the danger of infection and sepsis minimized. The advantage of suture over ligature is in the restoration of the circulation to the limb, obviating the dangers of gangrene and the tendency to gas gangrene infection. Ligation of the main vessel of an extremity when not followed by gangrene, results almost invariably in neurovascular disturbances of a more or

less serious character. These late complications may be avoided by suture, and the repair likewise does away with the potential danger of aneurysmal formation with its cardiovascular complications. If the suture does not prove entirely successful and thrombosis follows, the occlusion takes place so slowly that ample time is afforded for an adequate collateral circulation to develop. Thrombosis is prevented by the two important factors in the technic which I have described: (1) bloodless field with thorough washing away of all the clots from the segment to be repaired; (2) the removal of the adventitia from the edges of the wound. The condition of the soldier more or less exsanguinated demands transfusion rather than the administration of

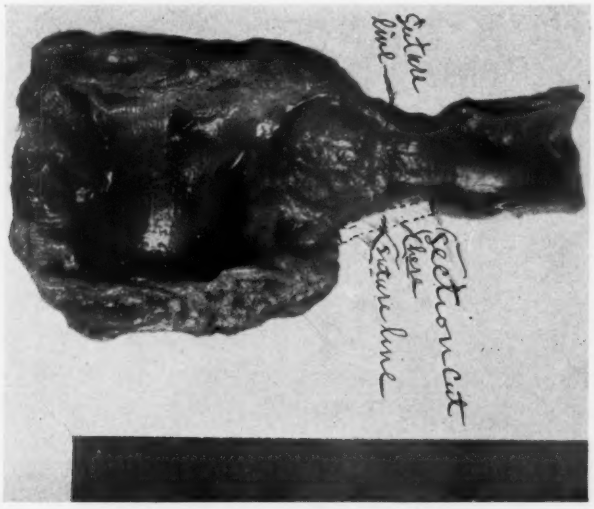

Fig. 8. Arteriovenous anastomosis of femoral vessels removed eighty-three days after operation; male adult, age thirty-five. Surg. Path. No. 3550. (Goodman, Charles. *Ann. Surg.*, July, 1917.)

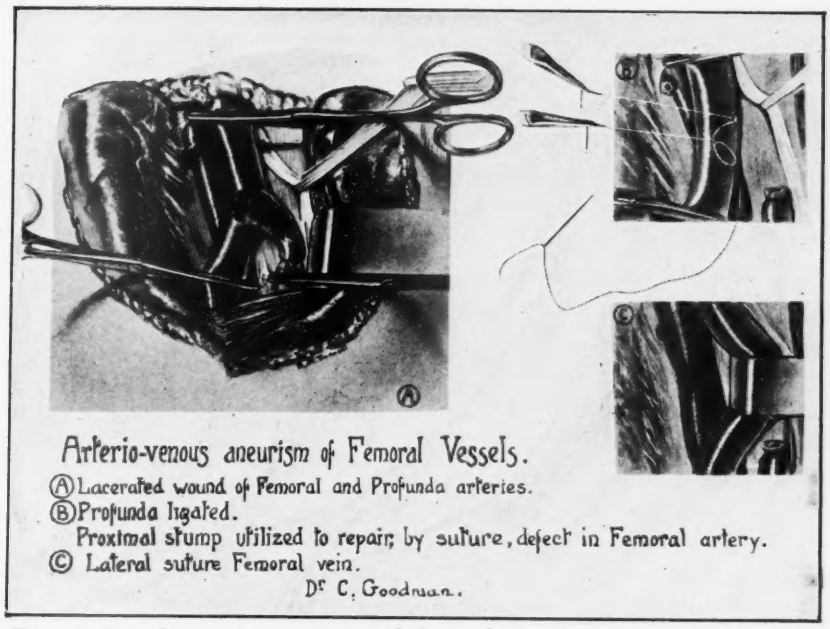
Arterio-venous aneurism of Femoral Vessels.
Ⓐ Lacerated wound of Femoral and Profunda arteries.
Ⓑ Profunda ligated.
Proximal stump utilized to repair by suture, defect in Femoral artery.
Ⓒ Lateral suture Femoral vein.
Dr C. Goodman.

Fig. 9. Arteriovenous aneurysm of femoral vessels. A, lacerated femoral repaired by reflecting stump of profunda and suture; B, lateral opening in femoral vein closed with continuous suture.

anticoagulants. Recently, the use of heparin has been advocated for the prevention of thrombosis in blood vessel surgery. In my

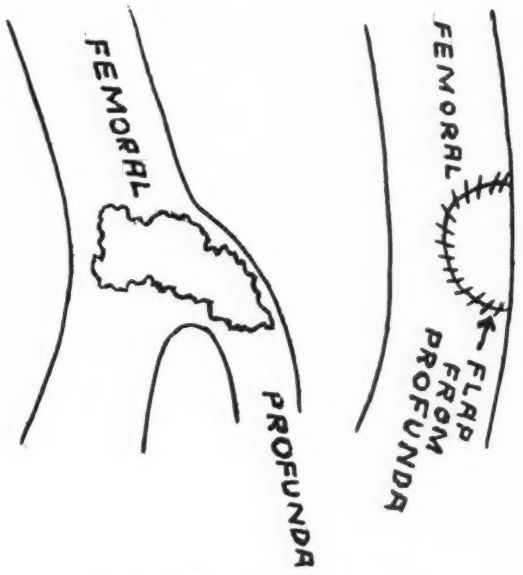

FIG. 10. Diagram of the procedure.

opinion heparin is not of value in the severely wounded requiring blood vessel suture.

When a portion or segment of an artery has been destroyed or completely carried away by the missile so that the severed ends cannot be readily approximated, one may resort to the use of a paraffined Tuffier tube. The tube is introduced into the respective severed ends of the artery. The flanged ends are secured by simple ligature which prevents them from being displaced. When removed at the end of several days, these paraffined tubes may be found partially or completely filled with soft coagulant, but an ample opportunity for the development of the collateral circulation will have been attained.

Under favorable circumstances, a segment of the saphenous vein can be interposed with the aid of a bipolar circular suture. The procedure will be followed by satisfactory and permanent restoration of the continuity of the vessel. In times of total war, civilian casualties as well as casualties in the armed services deserve the advantageous use of the blood vessel suture. What has been emphasized in regard to blood vessel repair in the advanced operating stations of the army, applies with equal force to the immediate treatment of the injured among the civilian population, as well as in the treatment of industrial accidents.

During the First World War, surgeons of the Central Powers appreciated the advantages of the vascular suture as against the obliterating ligature. Among these the leading advocates were: Bier, von Haberer and Stich.

The statistical results gathered and published in the second edition of Lehrbuch der Kriegschirurgie by Carl Franz, are illustrated in the following tables:

Operator	Suture	Ligature	Deaths	Total
Bier	74	28	8	102
Brunzel	0	8	2	8
Franz	15	41	9	56
Fromme	3	46	3	49
Graf	15	58	15	72
v. Haberer	122	50	10	172
Kuttner	24	67	1	93
Liek	0	25	13	25
Muller	0	17	8	17
Mutschenbacher	1	67	4	68
Mutschenbacher-Verbely.	No report	No report	3	40
Schwieker	2	15	0	17
Knolle	6	...	0	6
Zuckerkandl-Glas	12	90	34	102
Goldammer	26	28	1	54
Total	300	540	111	881

DEATHS FOLLOWING LIGATURE

Operator	Deaths	Total
Bier	2	16
Franz	7	41
Lick	13	25
Muller	8	17
Brunzel	2	8
v. Haberer	8	50
Mutschenbacher	3	67
Fromme	2	46
Subbotisch	9	75
Zuckerkandl-Glas	33	90
Goldammer	1	28
Total	88	463
Mortality	14.7%	

DEATHS FOLLOWING SUTURE

Operator	Deaths	Total
Bier	..	30
Franz	3	19
v. Haberer	2	122
Kuttner	1	24
Fromme	1	3
Knolle	..	6
Hotz	..	12
Subbotisch	3	30
Zuckerkandl-Glas	1	12
Goldammer	..	26
Total	11	284

Mortality following suture 3.8%

COMPARATIVE STATISTICS OF GANGRENE FOLLOWING LIGATURE AND SUTURE

Operator	Ligature and Suture	Ligature	Suture	Gangrene Following Ligature	Gangrene Following Suture	Gangrene Total
Bier	102	28	74	1	..	1
Franz	56	41	15	7	2	9
Goldammer	54	26	28	5	..	5
Graf	72	58	15	2	..	2
v. Haberer	172	50	122	..	..	..
Kuttner	93	67	24	..	1	1
Liek	25	25	...	11	..	11
Mutschenbacher	68	67	1	2	1	3
Schwieker	17	15	2	1	1	2
Zuckerkandl	102	90	12	23	4	27
Fromme	49	46	3	1	..	1
Total	810	513 63%	296 36.6%	53 10.5%	9 3%	62 7.7%

According to these statistics, gangrene followed ligatures in 10½ per cent while gangrene was observed in but 3 per cent of the cases following suture.

CONCLUSIONS

The blood vessel suture, in place of ligature, undertaken in the advanced operating centers does not entail great difficulties and should be taken advantage of more frequently by our army surgeons. Experiences gathered indicate that the danger of secondary hemorrhage following suture is a negligible one. The restoration of the circulation in a damaged vessel obviates the danger of gas gangrene. The neurovascular disturbances frequently observed following the obliterating ligature are avoided by the restoration of the circulation following blood vessel suture.

The simplified technic of blood vessel suture outlined and perfected by Carrel and taken advantage of in hundreds of cases by the surgeons of the Central Powers during the First World War, have been followed by most satisfactory and brilliant results.

Ample observations of vascular sutures performed in animals as well as in human beings confirm the perfect healing of the line of suture despite the presence of a more or less scar line. The illustrations appended demonstrate clearly how perfectly the intima is reproduced by prompt endothelial proliferation.

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THE FALLACY OF PERITONEAL DRAINAGE

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DURING the first two years of the first World War peritonitis from gunshot wounds of the abdomen caused a mortality of close to 100 per cent. Then British Army surgeons began to close the peritoneum without drainage, after carefully suturing all perforations of the hollow viscera. The mortality immediately dropped to about 50 per cent.

In the quarter of a century since this epochal discovery, relatively few American surgeons have profited by it, as is shown by the almost universal mistreatment of appendiceal peritonitis. Our new army is staffed by these same civilian surgeons. Unless they are aware of the deadly results of drainage in general peritonitis, it seems probable that about one-half of our battle casualties involving the abdomen will result in unnecessary deaths. It is the purpose of this paper to prove the truth of this seemingly extreme statement.

In 1905, Yates[1] proved that the peritoneal cavity could not be drained by any method whatsoever. The drains were always walled off within a few hours. His findings have been confirmed by many investigators and refuted by none. Why then do the majority of writers of the subject advocate drainage in peritonitis? If they are at all familiar with the literature, they know that they advise and attempt the impossible except in the case of walled-off abscesses. Their self delusion in the case of diffuse peritonitis is an example of the perpetuation of a fallacy for nearly half a century after the fallacy was exposed.

In 1897, John G. Clark analyzed 1,700 cases of abdominal section at Johns Hopkins Hospital. He concluded that not only is drainage useless in the great majority of cases in which it had been used, but that it was frequently productive of harm.

In 1908 Robert T. Morris,[2] impressed by Clark's study, reported that in cases of appendicitis with pus and peritonitis he had closed without drainage for about a year with no deaths and no increase of peritonitis.

In 1931, Buchbinder and his associates,[3] experimenting on dogs, produced a widespread peritonitis by opening a loop of bowel and leaving it open for twenty-four hours. They then reopened the abdomen and removed the source of infection by closing the bowel. In fifty-three animals so treated thirty-three were closed without drainage, and nineteen or 57.5 per cent died. In the remaining twenty animals two drainage tubes were inserted, one in the upper abdomen and one in the pelvis; all died.

These experimental results are in conformity with surgical experience. For the sake of brevity only a few typical reports will be quoted.

Haggard and Kirtley[4] quote the experience of Giertz who in patients with purulent appendiceal peritonitis operated upon in the first forty-eight hours, reduced the mortality from 22.2 to 3.5 per cent by primary closure of the peritoneum. These authors also state that the mortality of generalized peritonitis "averages 41.2 in some of our best clinics."

In 1939, Kelly and Watkins[5] reported that of 171 patients treated by drainage forty-four died, 25.7 per cent, while of nineteen patients treated without drainage only one died and that from postoperative pneumonia.

Convincing evidence is furnished in a remarkable paper of Storck,[6] who reported forty-six cases of penetrating wounds of the abdomen of which thirty-five were gunshot and eleven were stab wounds. The number

of perforations in the patients who survived averaged 5.44, with a maximum of twenty-five in a single case. These perforations included practically every viscus in the abdomen. The mortality in the cases of stab wounds was 27.2 per cent; and in gunshot cases 40 per cent; and the combined mortality was 37 per cent.

In spite of hemorrhage, shock and gross spillage of intestinal contents from multiple perforations, these figures compare favorably with the mortality of simple perforative appendicitis as reported by some of our best clinics. If one asks how this can be possible, he may find the answer in this sentence from Storck's paper: "Because of the impossibility of draining the peritoneal cavity and because of the danger of intestinal obstruction resulting from the introduction of drains into the peritoneal cavity, the intraperitoneal introduction of drains at the time of operation for penetrating wound of the abdomen is now considered futile." This report should be "must" reading for every military surgeon.

Space does not permit even a summary of the many reports of improved results following the abandonment of the drain, but a few of the writers are: Shipley and Bailey, H. C. Miller, E. P. Hall, Sr., R. D. Kirk, Jr., Stanley Raw, B. Banks-Marchini, J. G. Andrew. It is significant that in a rather extensive review of the literature I have failed to find a single report of a surgeon's return to the use of drainage after he has discontinued its use.

Failure to grasp the significance of all this experience is exemplified by two of many similar recent reports.

In July, 1940, King[7] in a study of 804 cases of acute appendicitis at the Binghamton City Hospital during the years 1934–1937, states, " . . . the records show a definite trend toward less frequent drainage in acute appendicitis. Almost without exception, however, drainage was used in peritonitis cases. . . . In all, 277 cases were drained. Of these 216 were cases of peritonitis (only four peritonitis cases were not drained) while sixty-one drained cases were uncomplicated by peritonitis at the time of operation. . . .

"The cases complicated by diffuse peritonitis had appalling mortalities. In 1929–1930 the mortality in this group was 63.6 per cent, in 1934–1935 it was 33.3 per cent; in 1935–1936, 75 per cent, and in 1936-1937, 85.7 per cent. The four-year average for thirty-two cases was 65.6 per cent, or roughly two deaths out of three cases."

As late as August, 1940, Jackson and Perkins[8] advocated not only drainage through the wound in all cases in which pus is present, but rubber tube drainage through a stab wound in the flank, and a drain to the pelvis if there is generalized contamination. Although their mortality rate for 100 cases was only 12 per cent, thirty-two of the one hundred developed complications including:

6 patients with general peritonitis; all died
4 patients with fecal fistula; one was associated with intestinal obstruction and died; one was associated with repeated hemorrhages and died
1 patient developed subphrenic abscess and died
1 patient developed septicemia and died

None of these complications has occurred in any of our cases of diffuse peritonitis treated by closure without drainage in the past thirteen years with the exception of one death from peritonitis reported below.

In any discussion of peritonitis, confusion results from ambiguous terminology. For the purpose of this paper peritonitis is either localized or diffuse (some authors prefer the term "spreading" for this type). By localized peritonitis is meant a collection of pus surrounded and limited by a definite wall of adhesions. It may be an abscess the size of a walnut or a cavity containing several ounces of purulent fluid. The essential point is that the pus is definitely walled off from the rest of the peritoneal cavity. Whatever its size, it is still an abscess. If the walls of this abscess are lined with intact peritoneum, it may be treated in the same way as diffuse peritonitis without drainage. If the walls are necrotic and the integrity of the peritoneal lining is impaired, or if any part of the wall

is not lined with peritoneum, the treatment does not differ from that of an abscess elsewhere in the body. It must be either loosely packed with gauze or adequately drained.

By diffuse peritonitis is meant an extension of purulent inflammation beyond the immediate source of infection with no definite limiting wall. It may consist of purulent exudate between loops of bowel agglutinated by fresh fibrin deposits, or a pelvis full of pus or an entire abdomen full of infective fluid. The term general peritonitis is properly applied only to the latter condition and it is of rare occurrence. In nearly all cases some part of the peritoneal cavity is kept free from infection by protective adhesions. It is in diffuse peritonitis that drains do the greatest harm.

In untreated peritonitis the cause of death is almost always overwhelming toxemia. After this toxemia has developed operation of any kind is usually futile. For that reason the nondrainage treatment is effective during the first forty-eight hours, after which time the mortality increases rapidly regardless of the form of treatment used. It is in these delayed cases that conservative treatment is indicated, because the defense mechanism of the peritoneum has been overcome by the invading bacteria and general body resistance must be reinforced. We are no longer dealing with a peritoneal battlefield, but a total war involving the entire body. At this stage local treatment is less important than the measures necessary to combat the effects of toxemia, exhaustion, dehydration, disturbance of the acid base balance, and paralytic ileus. No elaboration of these technics is necessary here because they are not germane to the question of drainage. The use of transfusions, sulfonamides, Miller-Abbot tubes, saline infusions, etc., when indicated are taken for granted.

On the other hand in the case of deaths following operation with the insertion of deep drains, autopsy usually shows that peritonitis at death is largely limited to the region of the drain. In these cases a frequent cause of death is intestinal obstruction and the obstruction is nearly always found in the region of the drainage tract.

Sir Samson Handley[9] believed that in generalized peritonitis death is never due to the peritonitis itself, but always to intestinal obstruction.

Shipley,[10] in describing the experiences which led to his discarding drainage says, "But there were a certain number who came to grief and in almost every instance intestinal obstruction was the complication present. Even when this condition did not actually exist there was often a period of uncertainty because of the presence of paralytic ileus or incomplete obstruction due to angulation. In the spring of 1930, within a few weeks, four patients on whom I had operated for peritonitis following appendicitis and drained, developed mechanical obstruction and two of them died. At operation all four were completely obstructed by angulation of a loop of small intestines *in the drain tract. The remainder of the peritoneum was free of adhesions or any evidence of infection.*"

In neglected cases in which a retrocecal abscess has formed, intestinal obstruction is also a frequent factor in the mortality but the obstruction is more often due to mesenteric thrombosis than to mechanical obstruction.

An analysis of our last 374 cases of acute appendicitis follows:

In 216 patients the appendix was acutely inflamed; none were drained; none of the patients died

97 patients had gross perforation and frank peritonitis, either localized or diffuse; 54 were drained; 13 died; mortality 24 per cent; 43 were not drained; 4 died; mortality 9.53 per cent

Of the four deaths in the undrained series only one was due to peritonitis. The other three deaths were all instructive.

In the first, the tip of the gangrenous appendix was retroperitoneal under the root of the mesentery. An abscess formed under the root of the mesentery and fatal mesenteric thrombosis resulted.

The second patient was a woman seven and one-half months pregnant. She was

convalescent with a normal temperature when on the seventh day miscarriage occurred with fatal collapse.

The third patient was a man of sixty whose whole lower abdomen was full of thick, foul smelling pus. He had complete suppression of urine and died of uremia on the seventh day. When on the fourth day severe vomiting caused a disruption of his midline incision (made because of a mistaken diagnosis) the peritoneum was everywhere normal, no adhesions had formed, and no pus was found. The absence of adhesions and the complete disappearance of pus within four days has been a startling and constant finding in the few cases which we have had an opportunity to explore. Shipley reports similar experience.

If we eliminate these three cases, we have one death from peritonitis in forty-three patients treated by nondrainage, a mortality of 2.33 per cent. Furthermore our mortality of 24 per cent in drained cases was largely due to the complications which made drainage necessary. They included delayed operations on patients who were extremely ill on admission, with large abscesses which were simply opened and drained without removal of the appendix. All the patients in the fatal cases had been ill for periods of from forty-eight hours to five weeks.

The important point is that most of our undrained cases with the low mortality were those of diffuse peritonitis while practically all of the drained cases with much higher mortality had walled-off abscesses. The advocates of delay and the Ochsner treatment base their position on the assumption that mortality is less if the pus is allowed to become localized. This assumption is perhaps true if drains are used in cases of diffuse peritonitis. It certainly is not true if these patients are treated by early operation, removal of the appendix, aspiration of the purulent fluid and closure of the peritoneum without drainage.

Neither the amount of pus, the character of the pus, nor the area involved has anything to do with the question. If the source of infection can be removed and if the peritoneum is intact, a drain is not only unnecessary but harmful.

To avoid residual abscesses the free pus should be removed with a Poole suction tube, especially from the pelvis. In order to do this effectively it is often necessary to separate loops of bowel agglutinated by fibrin. In the first forty-eight hours this fibrin is not organized into true adhesions. If a wet, gloved finger is gently used, loops can safely be separated without injury to the visceral peritoneum and no permanent adhesions will form. If this is not done the fibrin will exercise its function of forming a true adhesion to wall off the pus, with resultant abscess and permanent adhesions.

Diffuse peritonitis treated by nondrainage within forty-eight hours is no longer a serious problem. Every trace of pus has disappeared within four days and no adhesions occur provided that the source of infection is removed with no traumatizing of the peritoneal endothelium. (This implies the McBurney incision for direct approach and simple ligation without burial of the stump.)

Drainage is contraindicated in all types of diffuse peritonitis when the source of the infection can be eliminated, whether this be a pyosalpinx, perforated intestine or gunshot wound. We have closed without drainage more than fifty consecutive wounds in patients with acute salpingitis or tuboovarian abscess with no deaths, and no serious complications. Also, we have the satisfaction of knowing that few if any of these patients will suffer later from crippling adhesions.

SUMMARY

The nondrainage treatment is based not on theory but on overwhelming experimental and clinical evidence. Both experiment and experience have demonstrated beyond any doubt these facts:

1. It is physically and physiologically impossible to drain the peritoneal cavity by any means whatsoever.

2. In all types of peritonitis, removal of the source of infection, aspiration of pus, avoidance of injury to the endothelium and closure of the peritoneum is the only treatment required. If treated within forty-eight hours, the temperature will usually reach normal in three or four days, the exudate will be absorbed and permanent adhesions will rarely, if ever, be formed.

3. With such treatment deaths from peritonitis *per se* will seldom occur. Most deaths result from delayed operation, allowing abscesses to invade retroperitoneal tissues, from overwhelming toxemia, from mesenteric thrombosis, or from intestinal obstruction resulting from adhesions produced by the drainage tube.

4. Retroperitoneal tissues and the fascia and fat of the abdominal wall have none of the resistance of the peritoneum. Hence they should be drained or left wide open until healthy granulations form. Many such wounds can then be closed by secondary suture.

5. Since the success of nondrainage depends on the integrity of the peritoneum, a drain is indicated if the walls of an abscess are necrotic or lined with a shaggy gray membrane, if the retroperitoneal space is opened, or if bleeding cannot be completely controlled.

6. There need be no hesitation in gently separating fresh fibrinous adhesions in order to reach all collections of pus with the aspirator. Failure to do this may result in a localized abscess.

7. The more widespread the peritonitis, the less the indication for drains.

8. The time to operate is when the diagnosis is made. No surgeon lives who can tell with certainty what is going on inside the abdomen. With nondrainage there is nothing to be gained by delay and everything to be gained by removal of the source of infection as early as possible.

9. Appendiceal peritonitis has been used to illustrate the principles underlying the treatment by nondrainage only because of the great mass of evidence available in that particular field. Removal of the source of infection and omission of the useless and harmful drain is equally important in the treatment of battle casualties. The validity of the method was established beyond question in the last two years of the first World War.

With a long war facing us the life of every fighting man who suffers a penetrating wound of the abdomen will depend largely on three things: Control of shock, sulfonamides and nondrainage of the peritoneal cavity.

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RECONSTRUCTION OF THE COMMON DUCT WITH A VITALLIUM TUBE

CASE REPORT

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CASES have been reported in which following only a simple exploration of the common duct, a stenosing stricture or a fibrosis has developed with a resultant complete obliteration of the tube. To re-establish the flow of bile into the gastrointestinal tract at times is one of the most difficult procedures as the fibrotic process recurs and the new canal is obliterated. Having encountered one of these cases that required four operations before the continuity was definitely re-established by means of a vitallium tube, I believe it is worth reporting in detail:

CASE HISTORY

C. M., a male, thirty years of age, was first operated upon September 2, 1940, for chronic cholecystitis and cholelithiasis. A simple cholecystectomy was done. On September 9, 1940, a week later, he was operated upon again as he had developed an acute jaundice and the operating surgeon stated that thick, inspissated bile and sediment were found in his common duct. A T tube was placed in the duct which remained *in situ* for over eight weeks and then the biliary fistula gradually closed and the patient improved. His jaundice cleared and he apparently passed all his bile in his stools.

He was well until the end of January when he slowly became jaundiced. The stools were clay-colored and he had a terrific itch. There was very little temperature and very little loss of weight. His blood count showed concentration but no leucocystosis. His icteric index was 192 and his clotting time was three and one-half minutes. He came under my care at that time and after proper preoperative measures he was explored on February 18, 1941.

At this operation after dividing a mass of adhesions the base of the liver was finally exposed with great difficulty, and what appeared to be a remnant of the common duct was identified. It had been replaced by a long, thick fibrous band, and although in the central portion there was a small lumen with some fluid, it was completely stenosed at the base of the liver and at the point where it disappeared behind the duodenum. After a great deal of difficulty the stenosis at the upper end was broken through and a catheter was inserted into the base of the liver. The patient was pretty well shocked by this time and the abdomen quickly closed. He was given a blood transfusion and his general condition improved but it was not until the following day that a profuse drainage of bile began. As the possibility of a malignancy was considered, some of the tissue removed about the duct was examined but this was reported as only chronic inflammatory tissue. He left the hospital on March 29th with a well established biliary fistula, and the stools acholic.

On May 14, 1941, he was re-admitted to Misericordia Hospital as the biliary fistula had gradually closed. On the day preceding this admission, following an attempt to pass a bougie into the tract, the patient had a severe chill, sharp abdominal pain and a temperature of 104.4°F. A white blood cell count showed 23,000 cells and 95 per cent polymorphonuclears. There was acute tenderness over the whole liver and a diagnosis of acute hepatitis was made. He was given 4 Gm. of sulfathiazole every four hours and poultices were applied to the abdominal wall. His temperature dropped to normal in four days and the fistula opened up. A catheter was introduced into the sinus tract and the patient discharged.

On June 8, 1941, he again entered the hospital. At this time the catheter was still in the tract, the bile was being collected in a bottle and the patient was taking about 4 ounces of his own bile daily with his food, without nausea. After proper preoperative preparation

he was operated upon June 11th. The biliary fistula was dissected out and the cutaneous end was implanted into the prepyloric end of the

Fig. 1. Showing catheter in biliary fistula tract collecting bile in bottle. The shiny reflection on the skin is from the aluminum powder.

stomach suturing this around the tract and to the inferior surface of the liver. A small cigarette drain was left near the anastomosis and the abdominal wall closed. His postoperative course was faintly stormy; the temperature rose nearly to 105°F. and then slowly dropped. Aspiration of the Levin tube that had been introduced into the stomach showed the presence of bile. On June 14th, the drain was removed as there was no biliary drainage. However, several days later there were some bile stains on the dressings. Within a few days the stools were found to contain bile and the patient went home.

On October 13, 1941, he was re-admitted because in the last three months he had had several attacks of jaundice with fever and now was again jaundiced and the stools were acholic. After a consultation it was decided that he again had strictured and should be explored. The next day he was reoperated upon. A mass of adhesions were found and after these were divided, it was found that the stricture had reformed at the base of the liver. The rest of the tract had become a small fibrous tube with some dark fluid in it. The opening into the stomach was closed. The stricture at the base of the liver was split again and one end of a T tube introduced into the hepatic ducts and then the old fistulous tract sutured around the tube and the other end inserted into an opening that had been made into the stomach. The whole area was reinforced about the tube and the long end brought out on the abdominal wall; the usual drain was inserted and the abdominal wall closed. Bile began to drain immediately.

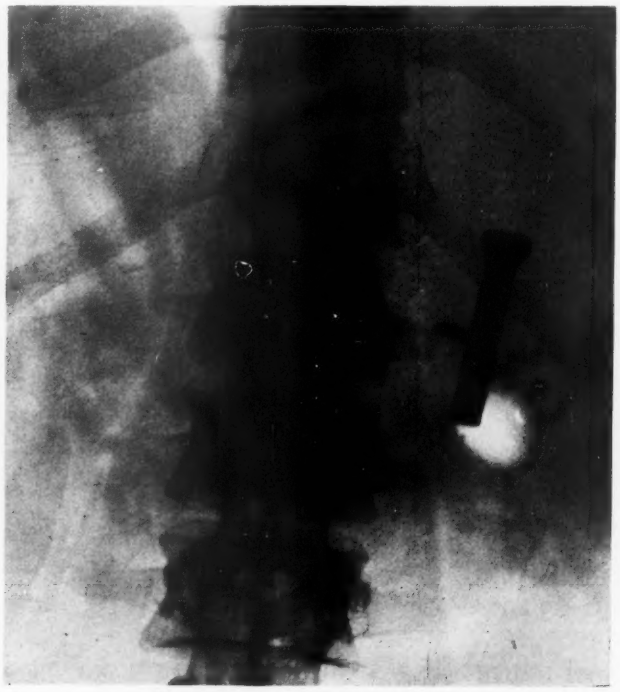

Fig. 2. *X*-ray film showing vitallium in place nine months after the last operation.

Again he had quite a reaction, but he eventually left the hospital on November 3rd with

most of the bile coming through the tube and only a faint trace in the stools. About the end of November, the tube came out. On December 15th, he was re-admitted as the fistula had closed; there was no bile in the stools and he was severely jaundiced. The following day the closed end of the tract on the abdominal wall was excised and this allowed a free flow of bile. On December 23rd, some lipiodol was injected into the tract but only a very small amount entered. The *x*-ray film was read by Dr. R. Pound who reported that the lumen of the tract was very narrow and that there was a stenosis or contraction at the junction of the hepatic and common ducts. Apparently, the communication into the stomach had again closed.

On January 28, 1942, he entered Bellevue Hospital for study. His icteric index was 77. Aspiration of gastric contents showed no evidence of bile but acidity within normal limits. A flocculation test did not show liver damage. His jaundice was severe. The wound in the skin was re-opened but shortly afterward closed again, and the patient decided to go home unimproved.

On February 26th, it was decided to make a final attempt to re-establish a communication between the liver and the gastrointestinal tract. At this operation a stricture was found immediately beneath the skin, then a thinned-out tract extending to the base of the liver, where the usual firm stricture was found again. There was no communication with the stomach. The old abdominal scar was excised and the usual dissection carried out. When the stricture at the base of the liver was found it was split widely, clear bile obtained again and then the region about the opening cleared thoroughly. The wide end of a 4 cm. vitallium tube was inserted into what was left of the common duct. It was anchored here with silk sutures, then the other end of the tube inserted into a small opening in the prepyloric end of the stomach. The rest of the opening was closed with chromic sutures and then the stomach sutured close around the tube and to the inferior surface of the liver. A small drain was introduced and the abdominal wall closed with mattress sutures and silk.

He reacted well but on the third day he apparently had a massive hemorrhage from his stomach as he passed nearly 500 cc. of pure blood in his stool. He received another transfusion and although he continued to pass tarry stools for about a week he steadily improved and regained his strength. At the end of the tenth day there was no further bile stain on the dressings and the following day the stools were positive for bile. He left the hospital sixteen days after this operation with the wound completely healed. A fluoroscopic examination showed the vitallium tube in place. His stools were normal in color and his icteric index had dropped to 33.

Throughout all these operations the patient never had any gastric upsets and never vomited up any bile.

Since this last operation the patient has regained his strength, put on about twenty pounds, eats well, digests his food well and has not re-opened his skin fistulous tract. At present the *x*-ray film shows the vitallium tube still *in situ*.

COMMENT

This case apparently is similar to others already reported in which a fibrosis and strictures occur in the common duct following a simple cholecystectomy.

There is no doubt that the patient had a functioning common duct following the second operation as he was not jaundiced for many months and there was only a gradual obstruction after that.

At the third operation there was only a fibrosed tube with two strictures representing the remnants of the common duct. All the other operations showed the same fibrotic process developing over and over, with one stricture at the base of the liver and the other at the skin margin while the opening into the stomach would become obliterated.

It is of interest to note that the usual steps in the re-establishing of the continuity of the biliary system with the gastrointestinal tract all failed in this case until the vitallium tube was used. Apparently this procedure (it is now nine months) has succeeded.

Finally, it is to be noted that the patient was able to drink his own bile and has had no gastric disturbance in spite of the fact that he has a permanent biliary fistula into his stomach.

RECURRENT LARYNGEAL NERVE IN THYROID SURGERY

TRIANGLE FOR ITS RECOGNITION AND PROTECTION

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SAFE thyroid surgery demands a detailed knowledge of the surgical anatomy of the recurrent laryngeal nerve. Notwithstanding the centuries that have elapsed since the reputed discovery of the recurrent laryngeal nerve by Galen,[14] it is doubtful if there has been another nerve in the body which has given rise to so many diverse and fanciful theories to account for its anatomical peculiarities.

Anatomists and surgeons[6,8,9,10,12,15,20,30,35,39] still differ considerably in their descriptions of the course and structure of the recurrent laryngeal nerve. Some authors describe the nerve as lying directly in the tracheo-esophageal groove; while others describe it as lying in a lateral position. Charles C. Higgins[18] carried out a series of dissections to determine the position of the nerve and describes it as passing obliquely upward to the side of the trachea from its point of origin. Crile[7] has described this nerve as an exceedingly soft and very vulnerable structure. He states that the recurrent laryngeal nerve is "naked" as is the brain and spinal cord, and that the slightest direct or even indirect pressure on the nerve interferes with its conduction and immediately changes the voice. Berlin,[1] however, presents clinical and histological evidence to show that the recurrent laryngeal nerve closely resembles an ordinary peripheral nerve with all the firmness and tensile strength of a peripheral nerve and that its vulnerability to trauma is not as great as previously supposed. Lahey,[23] who has demonstrated the recurrent laryngeal nerve in 3,000 operations, states that it is of sufficient size so that it can be dissected out and visualized without harm, and that it has sufficient body so that it can readily be palpated as it is pushed against the rigid tracheal wall. These observations[1,23] are in accordance with the animal experiments of Judd, New and Mann[21] who demonstrated that stretching the recurrent laryngeal nerve does not result in any impairment of its nerve function, but that pinching causes temporary paralysis, and that permanent paralysis follows only ligation or severence of the nerve. More recent observations have confirmed this.[1,7] It is interesting to note that Doyen,[11] Sebileau, Victor Pauchet,[38,32] and others[4] many years ago advocated and considered dissection and visualization of the recurrent laryngeal nerve a safe procedure in the performance of thyroidectomy.

Thyroidectomy is now a common operation and with such a low mortality that it is being performed more frequently by an increasing number of surgeons. The recurrent laryngeal nerve, however, still dignifies the operation because various clinics continue to report from 1½ to 5 per cent of nerve injuries. And it is probable that the incidence of injury to this nerve is even higher than the present inadequate statistics would indicate, for the many methods of treatment for paralysis of this nerve which have been described must bear witness to the increasing frequency of injury. Massage, electrical and local applications have been advocated. Recently, contributions to recurrent nerve anastomosis have been made by Frazer,[13] Charles Ballance,[41] Lahey and Hoover.[24] However, no method of treatment to date has yielded satisfactory results and hence prevention is paramount. Only those who have seen injuries to this nerve severe enough to require tracheotomy can appreciate its

importance. The nightmare of bilateral nerve paralysis is always uppermost in the surgeon's mind when doing thyroidectomy. The writer believes that these injuries are largely avoidable and it is the purpose of this paper to point out an anatomical guide to the position of this nerve in relation to the thyroid gland.

Kocher,[22] the father of thyroid surgery, advocated partial thyroidectomy under local anesthesia because in this manner the patient could co-operate by speaking and thus register any injury to the nerve. Hertzler[17] and many other surgeons have continued to advocate local anesthesia for this reason, and attempt to avoid injury of the nerve by separation of the posterior capsule from the back part of the gland. This procedure is believed by some to obviate all dangers of nerve injury because of the concept that the nerve is external to the capsule, and when the capsule is stripped back the nerve is carried with it out of harm's way. They would prefer not to see the nerve during thyroidectomy. While every student of surgery knows the general position of the recurrent laryngeal nerve, yet the greatest tragedies which follow thyroid surgery result from injury to this structure. Berlin[1] and Lahey[23] have, therefore, advocated routine dissection and visualization of the nerve in thyroidectomy. The latter recently reported a series of 19,700 thyroidectomies with a mortality of 0.76 per cent and a reduction of the incidence of recurrent laryngeal nerve injury from 1.6 to 0.3 per cent in the last 5,000 cases in which the nerve was visualized. These observers have demonstrated that routine dissection and demonstration of the nerve, even palpation while on moderate stretch has caused no interference with its function either immediate or late. To dissect and visualize the recurrent laryngeal nerve it is necessary to elevate the lobe of the gland out of its bed. While some observers[7] have taught that recurrent laryngeal nerve injury is caused by traction on the gland during removal, our present knowledge, based on anatomical and surgical studies on large series of cases, appears to confirm the fact that injury to the nerve is more frequently the result of operative trauma. It is usually direct injury by forceps or knife or by rough sponging or by rough packing to control bleeding that recurrent laryngeal nerve damage is done. Competent observers[7] have pointed out that exposure of the recurrent laryngeal nerve in thyroid surgery is not only a safe and justifiable procedure but that it tends to diminish if not largely eliminate injury to the nerve. Of course, there will be the occasional poor risk patient with Graves disease in whom it may prove difficult to find the nerve and in whom the saving of time will be of greater importance than the demonstration of the nerve. However, any surgeon who has made himself perfectly familiar with the usual position of the recurrent laryngeal nerve by having visualized it in fifty or more cases is less apt to injure this structure.

Exposure is one of the fundamental principles of surgery. What one sees he can avoid and anything which cannot be seen, especially if it is in the operative field is in danger of injury. The finding of the recurrent laryngeal nerve, however, has proved difficult at times and I believe this is probably the chief reason why so many operators have preferred not to visualize the structure. The writer encountered this same difficulty in the beginning and solved this problem through a small anatomic experience gained through dissection of this region and the performance of thyroidectomy in more than 100 patients. In all of those cases thyroidectomy was done under local infiltration anesthesia (½ per cent novocain). There was, therefore, no race against time. With local anesthesia the respiration is quiet, and the venous pressure is not increased as is inevitable in any closed system of general anesthesia; hence the bleeding is less. This permits a more anatomic operation in which meticulous attention can be paid to hemostasis and anatomic detail. The purpose of this paper is to pass on this anatomic wrinkle in the

hope that it may prove as helpful a guide to others as it has to me in the visualization of the recurrent laryngeal nerve.

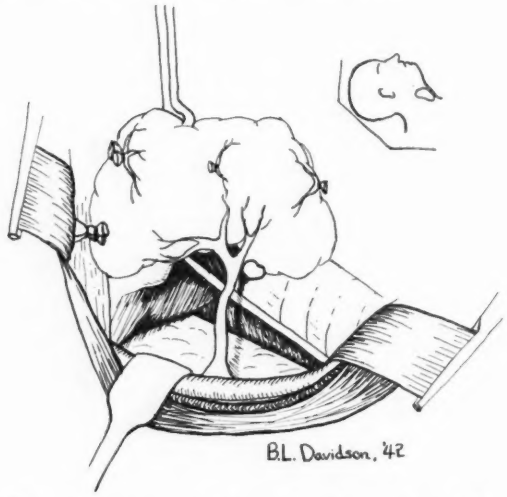

FIG. 1. Exposure of the triangle on the right side. The superior pole has been doubly ligated and divided and the middle and inferior thyroid veins have been ligated and detached. The lateral lobe of the thyroid gland has been dislocated and rotated from its bed exposing the posterolateral surface of the lobe. With the lobe thus elevated and the internal jugular vein and common carotid artery retracted outward, the loose areolar tissue between these vessels and the trachea is exposed. In this area the common carotid artery, the inferior thyroid artery and the recurrent laryngeal nerve form the triangle.

A good light and a dry field are essential. After the superior pole has been doubly ligated and divided, and the middle and inferior thyroid veins have been ligated and detached, the lateral lobe of the thyroid can be dislocated and rotated easily from its bed, thus exposing the posterolateral surface of the lobe. With the lobe elevated and rotated toward the midline and the internal juglar vein and common carotid artery held outward by a blunt retractor, the loose areolar tissue between these vessels and the trachea is exposed. (Fig. 1.) In this area the trunk of the inferior thyroid artery can be felt pulsating and seen emerging from underneath the common carotid artery just below the level of the cricoid cartilage. (Fig. 2.) The carotid tubercle (Chassaignac's tubercle) can be felt at this level against which the common carotid artery can be compressed. The carotid tubercle and the cricoid cartilage are at the same level and are fixed guides to the inferior

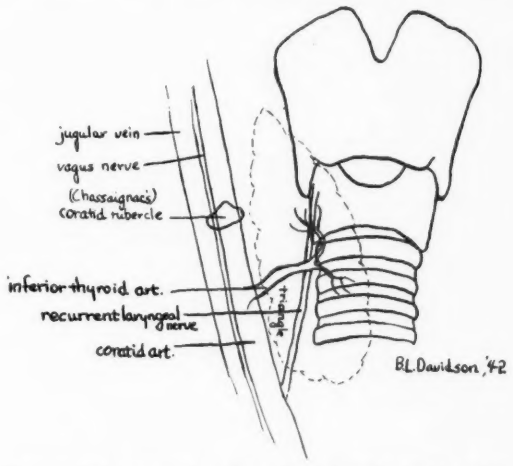

FIG. 2. Diagram showing the triangle in its relation to the larynx, trachea and large vessels. Note that the carotid tubercle against which the carotid artery can be compressed is at the same level as the cricoid cartilage (sixth cervical vertebra). The triangle is below that level.

thyroid artery which emerges just below their level to enter the gland. The vessel enters the lobe transversely on its posterolateral aspect at about the junction of its lower and middle thirds. (Fig. 2.) Textbooks of anatomy have pictured the inferior thyroid artery as a vermilion colored structure entering the inferior pole of the thyroid gland, a direct invitation to a ligature. This may be true for the inferior thyroid vein which frequently emerges at the lower pole. Actually, the inferior thyroid artery is deeply situated as illustrated and described above. The inferior thyroid artery can be palpated and seen as it runs transversely from underneath the carotid artery to approach the junction of the lower and middle thirds of the lobe. After the inferior thyroid artery is located in the manner described it can be exposed by blunt dissection and isolated and a ligature passed around it with a carrier if necessary. Usually by the time the inferior thyroid artery has been isolated the course of the recurrent laryngeal nerve has been visualized.

The writer has noted a constant triangular relationship between the common

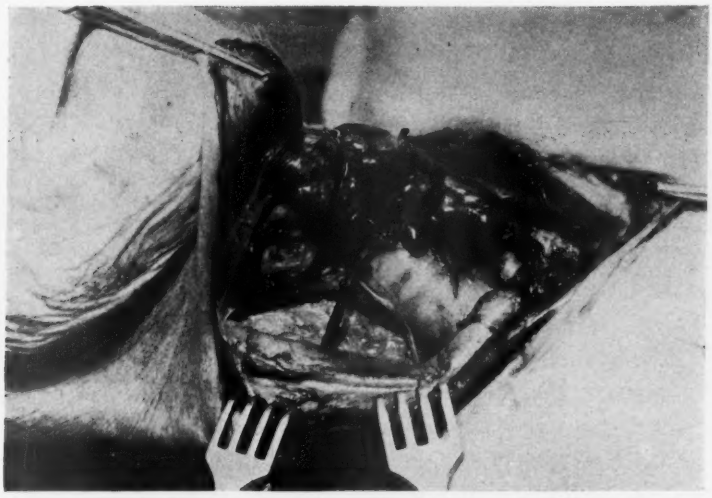

FIG. 3. Actual photograph of the author's dissection of the recurrent laryngeal nerve showing the triangle on the right side. The inferior horn of the thyroid cartilage has been bared in order to show the recurrent laryngeal nerve terminating under the horn. The superior pole vessels have not been severed in order to indicate the preferred site of ligation; that is, above the level of the inferior horn of the thyroid cartilage. Note the parathyroid body just outside the triangle.

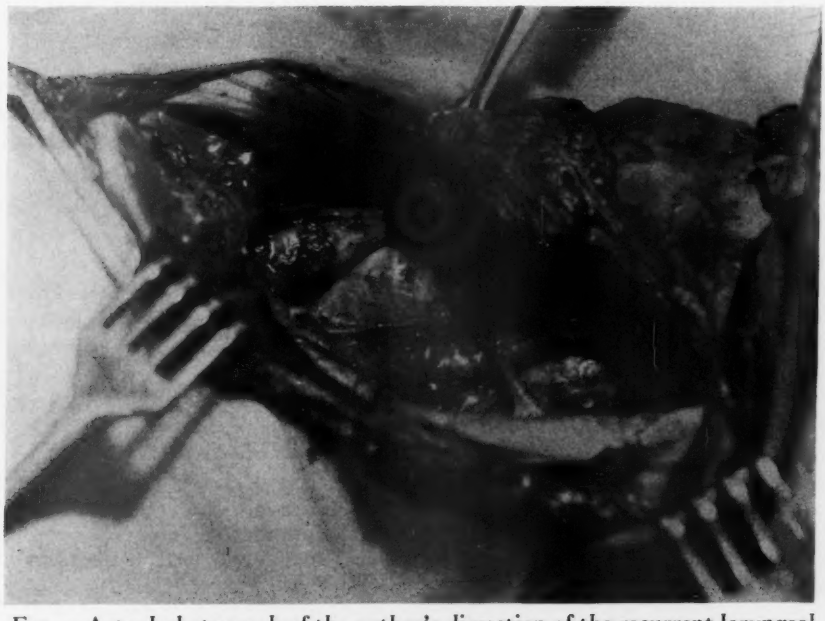

FIG. 4. Actual photograph of the author's dissection of the recurrent laryngeal nerve showing the triangle on the left side. The recurrent laryngeal nerve runs somewhat deeper on the left side. It courses up along the tracheo-esophagel groove to terminate under the inferior horn of the thyroid cartilage. The triangle however, is maintained. Note superior pole vessels above the level of the inferior horn of the thyroid cartilage. Note that the esophagus is more prominent on the left side and partially forms the floor of the triangle whereas on the right side the floor is formed almost entirely of areolar connective tissue.

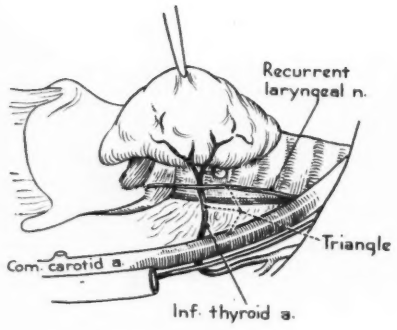

FIG. 5.

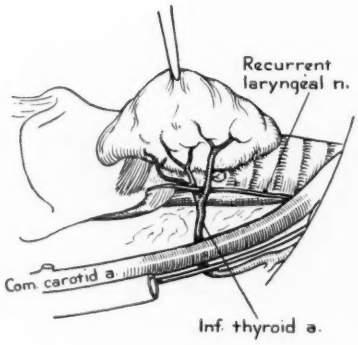

FIG. 6.

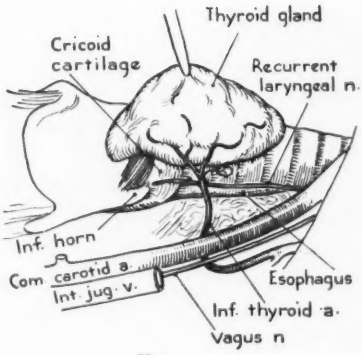

FIG. 7.

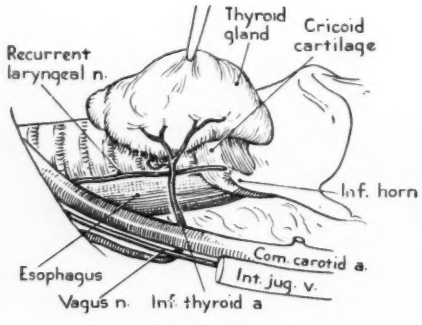

FIG. 8.

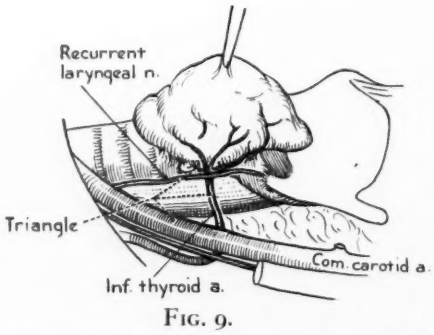

FIG. 9.

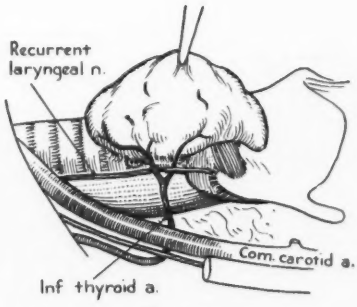

FIG. 10.

FIG. 5. Drawing of the author's dissection showing the triangle on the right side with its three boundaries. The recurrent laryngeal nerve is here anterior to the inferior thyroid artery. This is an occasional relationship and occurred seven times in eighty-six triangles dissected by the author in forty-three cadavers.

FIG. 6. Drawing of the author's dissection showing a triangle on the right side with the recurrent laryngeal nerve passing between the branches of the inferior thyroid artery. This is an uncommon relationship and occurred four times in the eighty-six triangles. Note the intimate relationship of the upper branch of the inferior thyroid artery to the recurrent laryngeal nerve.

FIG. 7. Drawing of the author's dissection showing the triangle on the right side with the recurrent laryngeal nerve posterior to the inferior thyroid artery. This is the usual relationship and occurred thirty-two times in the eighty-six triangles. Note that the floor of the triangle is formed almost entirely by loose areolar connective tissue.

FIG. 8. Drawing of the author's dissection showing a triangle on the left side. The recurrent laryngeal nerve is posterior to the inferior thyroid artery. This is the usual relationship and occurred thirty-three times in the eighty-six triangles dissected. Note that the esophagus is more prominent on the left side and partially forms the floor of the triangle.

FIG. 9. Drawing of the author's dissection showing a triangle on the left side with the recurrent laryngeal nerve anterior to the inferior thyroid artery. This is an occasional relationship and occurred eight times in the eighty-six triangles. Note intimate relationship of upper branch of inferior thyroid artery to the recurrent laryngeal nerve.

FIG. 10. Drawing of the author's dissection showing another triangle on the left side with the recurrent laryngeal nerve running between the branches of the inferior thyroid artery. This is a rare relationship and occurred twice in the eighty-six triangles.

carotid artery, inferior thyroid artery and the recurrent laryngeal nerve. (Figs. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. See all figures.) The inferior thyroid artery emerges transversely, occasionally with a loop, from underneath the common carotid artery almost at a right angle. It forms the base of a triangle, the other two boundaries of which are the common carotid artery and the recurrent laryngeal nerve. The common carotid artery is somewhat larger than a goose quill, is yellowish in color, pulsates visibly and is easily recognized. The inferior thyroid artery, a branch of the thyrocervical trunk, is often somewhat larger than the superior thyroid artery, yellowish in color, pulsates and is easily recognized as it approaches the posterolateral surface of the gland. The recurrent laryngeal nerve is flattened, firm, somewhat smaller than the diameter of a match, is white in color, and can be seen running obliquely toward the trachea against which it can be palpated. It crosses usually behind, sometimes in front of the inferior thyroid artery, occasionally between its branches. (Figs. 5 to 10.) A triangle is thus formed with these three structures as boundaries. (Figs. 1 to 10.) This area is not infrequently the location of a parathyroid body. I have noted this triangular relationship on numerous occasions, and it was apparent to me that this triangle was similar in size and importance to Calot's triangle in biliary surgery. Calot's triangle is formed with the cystic artery as a base and the cystic duct and common hepatic duct forming the other two boundaries. Keeping Calot's triangle in mind has prevented injury in a vital area of cholecystectomy. Keeping the triangle described above in mind helps to prevent injury in a vital area of thyroidectomy. Nature is usually constant. The constancy of location of the recurrent laryngeal nerve has been noted by many others.[7,2,23] This constancy of location of the recurrent laryngeal nerve has been shown to persist no matter what the type of goiter and regardless of its size or depth in the chest.[23]

This triangular zone is thus visualized by going from the general to the particular. The carotid artery is immediately apparent, the inferior thyroid artery is easily identified emerging from under the carotid artery just below the level of the cricoid cartilage and carotid tubercle. The angle of approach of the recurrent laryngeal nerve here is quite constant as it passes upward obliquely to cross behind the inferior thyroid artery on its way up to the larynx. Thus the triangle is completed. The nerve then continues up and becomes intralaryngeal by passing under the lowest fibers of the inferior constrictor muscle. The triangular relationship described above can be visualized only when the operator is on the same side as the lobe. When ready to remove the left lobe, one must cross over so that the operator will be on the same side of the patient as is the lobe that is to be removed. While the nerve runs somewhat deeper on the left side, here, too, it crosses the inferior thyroid artery usually from behind and the triangular relationship is maintained. (Figs. 4, 8, 9, 10.) Anomalies of the recurrent laryngeal nerve are rare[23] but can be recognized if the triangle is sought for. The only anomaly which has been described in the literature is the anomalous course of the recurrent laryngeal nerve which seems to occur in about one in every 500 cases. In this case reported by Pemberton[34] the nerve separated from the trunk of the vagus at the level of the cricoid cartilage. The recurrent laryngeal nerve proceeds upward, after completing the triangle, to enter the larynx at the level of the cricothyroid articulation. The inferior horn of the thyroid cartilage can be felt at this level. (Figs. 1, 2, 3, and 5 to 10.) The nerve trunk can be palpated below the inferior thyroid artery at this point. Since the recurrent laryngeal nerve becomes intralaryngeal at the level of the inferior horn of the thyroid cartilage, it has been my practice never to ligate the superior

pole vessels of the thyroid without first palpating this inferior horn. If the superior pole vessels are, therefore, ligated above the level of the inferior horn of the thyroid cartilage, the terminal branch of the recurrent laryngeal nerve can be avoided.

Injury to the recurrent laryngeal nerve, however, is more often lower down and as a result of the relation of this nerve with the inferior thyroid artery.[7,23] It is the upper branches of the inferior thyroid artery as they approach the trachea to enter the gland that are not infrequently torn or cut across during thyroidectomy. It is in attempts to control these bleeding points when they retract at the laryngotracheal junction that the hemostat is liable to catch the nerve just before it dips into the inferior constrictor muscle. (Figs. 1, 2, 3, 6 and 9.) The writer has discussed this point with Doctor Charles V. Morrill, professor of anatomy at Cornell University Medical College, and it seemed quite obvious to us both that attempts to control bleeding by direct clamping and ligature of the upper branches of the inferior thyroid artery endanger the recurrent laryngeal nerve. When sharp bleeding in this area occurs extracapsular ligation of the trunk of the inferior thyroid artery is safer. Routine ligation of this vessel, however, is not necessary or desirable because this vessel must supply not only the remaining thyroid gland but the trachea, esophagus, muscles and parathyroids as well. Visualization of the inferior thyroid artery is highly desirable, however, for then it can be ligated if necessary, and in addition it forms a most important guide to the position of the recurrent laryngeal nerve since it forms the base of the triangle.

The triangle described above has been of considerable help to the writer as a guide to the position and protection of the recurrent laryngeal nerve; and the writer believes that it is a good relationship for the thyroid surgeon to keep in mind to help avoid trouble. Technical operative complications undoubtedly contribute to many thyroid deaths and it is in this vital triangular area where the complications occur. While hemorrhage from the superior thyroid can be controlled by compressing the carotid artery, hemorrhage from the branches of the inferior thyroid artery, however, cannot be controlled in this way since the inferior thyroid artery is a branch of the thyrocervical trunk. (Figs. 5 to 10.) Since the inferior thyroid artery is often larger than the superior and its branches in such close relationship to the recurrent laryngeal nerve, it is important to visualize the main trunk of this vessel before removal of the gland is begun. Inadequate control of bleeding from the inferior thyroid branches often prolongs the operation. The anatomic relations are interfered with, and attempting to control this hemorrhage by direct clamping or suture of the bleeding points may result not only in injury to the recurrent laryngeal nerve but to the parathyroids and even the trachea. (Note the intimate relationship of the inferior thyroid artery to the recurrent laryngeal nerve, trachea and parathyroid in the photographs and diagrams.) The prime requisite is, therefore, adequate exposure and especially of the triangular zone described above. Early exposure of this triangle before the removal of the gland is begun visualizes the course of the nerve and provides the trunk of the inferior thyroid artery for the control of hemorrhage from its branches should this become necessary. The writer has refrained from reporting this triangular relationship as an aid to visualization of the recurrent laryngeal nerve until he had employed it in a sufficient number of cases and found the relationship to be constant. A reasonably complete review of available American, English, French and German literature reveals that no one has described this method of visualizing the nerve as completing the boundary of a triangle.

CONCLUSIONS

1. The exposure of the recurrent laryngeal nerve in thyroid surgery has been

proved to be a safe and justifiable procedure and has markedly reduced the incidents of recurrent laryngeal nerve injury.

2. An anatomical triangle is described whose base is the inferior thyroid artery and whose apex is formed by the common carotid artery and the recurrent laryngeal nerve.

3. The described triangle is easily identified and remembered. It serves (1) as a guide and guard to the recurrent laryngeal nerve; (2) as a guide to the inferior thyroid artery; and (3) as a guide and guard to a parathyroid body.

4. It emphasizes a vital triangular area in thyroid surgery just as Calot's triangle brings to mind and emphasizes a vital triangular area in biliary surgery.

The author wishes to acknowledge with grateful appreciation the kind assistance of Dr. H. P. Carpenter, Pathologist to St. Francis Hospital; Dr. Louis Muzzicato my assistant, and Dr. Charles V. Morrill, Associate Professor of Anatomy, Cornell University Medical College.

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Experiments suggest that the disproportionate degree of tissue destruction caused by small high-velocity bomb splinters is due to the fact that particles lying in their path are thrown radially with sufficient violence to leave a central cavity around which tissues at some distance from the track are momentarily stretched.

RELATIONSHIP OF THYROTOXICOSIS TO THE PRESENT WAR EFFORT

ITS MODERN TREATMENT

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THE medical aspects of the present military emergency have been distinguished to a large extent by the number of nervous and psychiatric problems which the drafted men are presenting. Undoubtedly, a certain proportion of these will find their bases in a congenital imbalance of the nervous mechanism ordinarily intensified and brought to the fore by the problems of civil life and now considerably multiplied in its intensity by the strange environment of military life and of the fears which it brings forward. Some of these symptomatologies, at least, will acquire the characteristics of true thyrotoxicosis: exophthalmic goiter, Graves disease, Basedow's disease, primary hyperthyroidism. It is important that these cases be recognized by the draft boards before induction into the army, or, at least, very soon thereafter so that intensification of the disease by military environment can be forestalled. Proper cure of the disease will result in an individual who, while not fit in any way for combatant service, can and will still be able to fulfill many of the necessary noncombatant duties.

The statistics of Love and Davenport compiled from the conscription records of the War Department for the first World War, give the approximate frequency of endemic goiter among young men of draft age in this country. A regional intensity is shown in that there is a greater incidence and a larger number of severe cases in the middle northwest than on the eastern coast of the United States. According to Plummer, there was an increase in the intensity of the disease in the middle west from about 1924 to 1930 with a definite decrease since then in intensity and in the number of cases in which crises have occurred.

The following table contains a summary of this information:

State	Proportion for All Types Including Exophthalmic Goiter	Proportion for Endemic Goiter, per 1,000	Proportion for Exophthalmic Goiter
Idaho	30	27	3
Oregon	33	26	7
Washington	33	23	10
Montana	24	21	3
Utah	20	16	4
Wyoming	18	15	3
Alaska	21	13	8
Wisconsin	22	14	8
Michigan	18	11	7
North Dakota	12	9	3
Minnesota	11	8	3
Iowa	10	7	3
Illinois	13	8	5
Indiana	10	6	4
Ohio	11	6	5
West Virginia	12	8	4
Nevada	8	6	2
Colorado	9	5	4
North Dakota	12	9	3
South Dakota	7	4	3
Nebraska	..	2	
Kansas	..	1	
California	6	4	2
Missouri	9	4	5
Virginia	7	3	4
Pennsylvania	9	4	5
Rest of U. S.	2		

According to Pepper, there were 6,219 cases of exophthalmic goiter (2.78 per 1,000) in the armed forces of the United States during the first World War and 1,176 cases of simple goiter. He very rightly remarks that there is little reason

to believe that this disease will fail to occur just as frequently now. With the increased emotional aspects of this war I an inclined to believe that the number will be larger. This tendency seems to be shown in the statistics of McKinley who found that in a total of 209 rejections by the Medical Advisory Board for Hennequin, Sherburne, Scott, Wright and Carver counties, comprising both rural and urban communities, 7.6 per cent were rejected for hyperthyroidism. This is rather a large number.

The statistics on exophthalmic goiter compiled by Love and Davenport probably indicate a too high incidence of the disease. More likely the large majority had diffuse colloid or adenomatous goiters. True exophthalmic goiter was frequently not distinguished from the condition later classified in the army either as irritable heart of soldiers, disordered action of the heart, effort syndrome, or neurocirculatory asthenia, the incidence of which under the conditions then prevailing was high. This was emphasized by Peabody, Wearn and Tompkins for the American Army and by Lewis and his co-workers for the British Army, and was first noted by Da Costa in the American Civil War. Nevertheless, sufficient numbers of cases of thyrotoxicosis have, and are sure to occur again to make this an important problem in the medical care of enlisted men.

CLASSIFICATION OF CASES

For clinical purposes cases of thyrotoxicosis (exophthalmic goiter, Graves disease, Basedow's disease, primary hyperthyroidism) had best be divided into the following groups:

1. Classical cases of exophthalmic goiter showing all the cardinal symptoms of thyrotoxicosis, exophthalmos, rapid pulse, irritability and nervousness, swelling of the thyroid and loss of weight.

Although the severity of the illness may be of all grades, the great majority are more commonly of the severer type. The clinical manifestations are well marked; the basal metabolic rate is relatively high; diarrhea and loss of weight are frequently present; and the patients sometimes run high temperatures. Adequate preparation of the patient for subtotal thyroidectomy is commonly difficult. Operation carries with it, usually, a great degree of risk, and many of the fatalities fall into this group. Recurrences are very apt to follow.

2. Cases of thyrotoxicosis in which the cardinal symptoms are present with the exception of exophthalmos: Although here also all grades of severity can be found, usually the clinical disturbance is relatively mild. With the exception of exophthalmos the symptoms are distinct. The basal metabolic rate is commonly not very high. The preparation of the patient for operation is relatively easy; operation is not attended with any excessive degree of danger frequently present in the exophthalmic group; patients make a good recovery and the recovery is usually permanent.

3. Cases falling into any of the preceding two groups, but in which psychotic symptoms of one kind or another—usually of the excitatory type—form the chief subjective symptom for which the patient seeks relief. The cardinal symptoms of thyrotoxicosis are present and elicitable, but they seem to be without their usual emphasis. They are relatively mild in most of the instances. In some of the cases, the symptomatology is of such a nature that the underlying condition is not recognized as a form of thyrotoxicosis until an increase in the basal metabolic rate is discovered. The latter is usually relatively low, very rarely over 40 or 50. It will fall appreciably with ordinary therapeutic measures without the exhibition of iodine. Preparation for operation is somewhat disturbed by the mental disposition of the patient; but, nevertheless, it is relatively easy to accomplish. Operation is not accompanied by any untoward risk. Residual symptoms, as will be further elaborated, subsequently always include those related to the mental state.

4. Cases of localized adenoma of the thyroid with symptoms of mild hyperthyroidism: The patients are not very ill; the symptoms are not very marked; the basal metabolic rate is only midly elevated; preparation for operation is very easily accomplished; operation carries a minimum of risk; good recoveries are made and the latter are permanent. Subsequently, these patients do not carry any potentiality for recurrences of symptoms unless new adenomas develop.

GENERAL THERAPEUTIC CONSIDERATIONS—INTOLERANCE FOR HEAT

Because of their increased metabolism, tolerance for heat is decreased in patients with thyrotoxicosis. The body surface is warm, moist and frequently erythematous. Sweating is a common symptom. The patients require less bedclothes to be comfortable, lighter garments and lower room temperatures. It is notorious how severe postoperative febrile reactions are, and how badly these patients behave generally, when operation is done in the hot periods of our summer months; and some patients are lost under such circumstances from hyperthermia every year. This is a very important item in the make-up of these patients.

For this reason, and because in army life it is relatively easy to accomplish, all patients with any form of thyrotoxicosis, and especially those with exophthalmic goiter should be segregated to hospital centers on our northern, eastern and western seaboards where the heat never becomes excessive. The patients should never be sent to hospitals in our southern, middle and middle eastern areas where, during the summer, the temperatures and humidity are high. This is a most important point. Because of the large number of medical officers drawn from civilian life, the care of these patients should be entrusted to specialists who have hade adequate training and experience in the handling of this disease.

COMPLICATING FACTORS

There are two important complicating factors: (1) valvular or myocardial heart disease, and (2) diabetes.

Thyrotoxic patients with heart disease (thyrocardiacs) should be well prepared for the ordeal of subtotal thyroidectomy by the usual well tried physical and medicinal means. The preparation for operation should proceed along the preliminary régime outlined elsewhere in this communication until the heart condition is put in as favorable a condition as is possible. There should be no hurry about this. The final preparation for operation should be begun when this is accomplished.

Diabetes is a rather infrequent complication. With our modern means of combatting this disorder, it should give no great cause for alarm.

TREATMENT

Preoperative Preparation for Subtotal Thyroidectomy. No matter in which group the cases fall, the proper preoperative preparation is of paramount importance if success is to follow. Good results after operation and the degree of cure correspond completely and accurately to the thoroughness with which this is carried out, and with the degree of co-operation shown by the patient and by his family. The latter item is very much more important in this disease than is customarily understood because the very nature of the illness contributes an obstinacy of spirit and action which is not often seen in other diseases.

The object of all of this preparation is to reduce the toxicity of the disease to a state in which operation will not be attended with any excessive amount of risk, because it is found that when the toxicity of the manifestations are marked, operation is unduly dangerous and is followed by an excessive mortality. The prevailing guides upon which this judgment is made is based on the nervous symptoms exhibited, the pulse rate, the basal metabolic rate and the gain in weight. When the preparation has been adequate, the ner-

vousness of the patient is very much diminished, the pulse rate falls to less than 100 per minute, the patient stops losing weight and begins to gain and the basal metabolic rate falls to a low level, usually under 25. Practically speaking, one puts the patient through a course of medical treatment and tries to obtain as much of a medical cure as is possible.

The following régime for the preoperative preparation has been found to yield superior results:

1. *Rest in bed under hospital conditions.* It is not possible in the greatest number of the cases to prepare a patient properly at home. In the hospital the patient is under his physician's absolute control and all kinds of disturbances can be eliminated. These include absence from business and from business worries, no visitors and no other patients in the same room. Usually this is a complete test of the patient's and his family's willingness to co-operate.

2. *A high caloric diet, never less than 3,500 calories per day.* The patient may rebel against this after a few days, so that it is necessary to make sure that he takes the full amount of diet ordered. The patient should be weighed frequently—at least twice each week—to guard against any loss of weight.

3. *Plenty of sedation* is required given (a) in the form of medication and (b) by physical means.

Phenobarbital given in such dosage as to make the patient sleepy a good part of the twenty-four hours is preferred. Hydrotherapy in the form of the Priesnitz pack, given two or three times daily, is an excellent adjuvant sedative measure. The patient is wrapped in an old sheet, wrung out of water at a temperature of 60°F., and then covered with a second blanket. If one of the doses of the phenobarbital is given about fifteen or twenty minutes before the pack, the patient very commonly falls asleep in the pack and that is a very desirable feature. Occasionally the pack must be omitted because the patient is refractory toward it.

4. *The basal metabolic rate should be determined once each week* as, besides the clinical aspects, this gives a very reliable index of the improvement which has taken place.

5. *In the usual run of case, iodine had best not be administered* until the effect of the preliminary treatment has become apparent. Maximum preliminary benefit is obtained in from two to three weeks and is recognizable both by an amelioration in the general clinical picture and in an appreciable fall in the basal metabolic rate. At this stage and only at this stage, iodine in the form of Lugol's solution should be administered. The dosage should be adequate, not less than ten minims three times each day and sometimes somewhat more. When the patient responds adequately, a further betterment of the subjective symptomatology and a further fall in the basal metabolic rate occurs. Commonly the patient at this stage feels, acts and looks very well.

Therapeutic Effect of the Preliminary Preparation. The effect of all of this preliminary treatment will be one of three: (1) The cases which respond readily and quickly. These are the milder type of case, commonly in the group without exophthalmos and less frequently in the group with exophthalmos. The basal metabolic rate falls to a low level, 25 or less, the patient stands operation well and no untoward incidents occur. (2) The cases in which a moderate amount of difficulty is present, chiefly in that the basal metabolic rate falls very slowly or not to the low level to which we should like it to fall. These cases should be watched more carefully, the régime should be carried out more slowly and for a longer period. Usually our object is accomplished. (3) The cases in which marked difficulty in preparation is present. The difficulty is clinically apparent in that the patient's symptomatology does not improve, there is a persistent loss of weight, and the basal metabolic rate remains at a high level and does not fall.

Under such conditions the preliminary treatment without Lugol's solution should be persisted in for a much longer time. Only then, when all the possibilities of this are exhausted, should Lugol's solution be given. Rarely a dramatic response occurs; the symptoms improve and the basal metabolic rate quickly falls to the desired low level; or no improvement follows. The latter form the group of most difficult cases to manage and the difficulty sometimes is insuperable. If Lugol's solution produces no effect within twelve or fourteen days, the chances are that no further good will be accomplished by it as the patients have the tendency to become iodine fast.

This tendency is a very important and common item in the make-up of hyperthyroidism. It is important to remember that as far as possible iodine should not be administered until one is of the opinion, first, that all the possible good has been accomplished by the preceding preliminary treatment, and, second, that the patient is about ready for the final preparation for operation. Then the iodine should be given in adequate dosage for a period not exceeding twelve days and the patient should be operated upon immediately. If operation is not done at this most opportune moment, it commonly happens that the good effect of the iodine as a preparatory measure for operation is lost (i.e., the patient becomes "iodine fast") and operation done subsequently is done at an increased risk.

Operative Treatment. Operation is the final stage of the active treatment. Satisfactory results are obtained only by removal of an adequate amount of thyroid tissue, i.e., by subtotal (bilateral) thyroidectomy. Other operative procedures such as pole ligation or any unilateral operations can be considered only as preliminary procedures for the former. These are commonly referred to as stage operations.

It is my firm opinion that when a patient is so sick that stage operations must be considered, he is not ready for any operation, either because of the severity of the illness or because he has been badly or insufficiently prepared. When a patient with thyrotoxicosis has been well prepared, a complete operation can be done in one sitting with no more risk than with a partial or stage operation. As a matter of fact, when the stage operation must be considered, it is my experience that the latter, even a unilateral pole ligation, carries infinitely more risk than a complete subtotal thyroidectomy on a patient well and adequately prepared. It is always my hope that patients will come at an early stage of their illness and before iodine has been given. Then with any kind of cooperation on the part of the patient and the patient's family, preparation can always be done properly and adequately. Then, too, I am always able to do the entire operation at one sitting with as little risk as possible.

An important point to remember is that neither the patient nor the family know when the operation is to be done so that no undue nervous tension is provoked. The patient is put through a sham immediate preparation for operation so that when the time comes, the true final preparation can be carried out without awakening any suspicion that operation is about to be done. This is very important.

For this reason, also, avertin given by rectum is the anesthetic and anesthesia of choice. The nurse gives this to the patient as she customarily does an ordinary enema and the patient falls asleep calmly without any rise of pulse rate. This is done in the patient's room, and the anesthetist and the operating room environment is not visible to the patient.

The steps of the operation are well known and need no repetition here. Suffice it to say that only a small strip of thyroid tissue at the posterior border of the gland on either side is left with a small segment of the upper pole. The raw area of thyroid tissue is closed by suture. Proper precautions are of course necessary that neither

the recurrent nerves nor the parathyroid glands are injured or removed accidentally. I usually drain either side of the neck with a small tube for twenty-four or forty-eight hours. This does not interfere with healing and the wounds are usually entirely healed by the end of the week.

Lugol's solution is continued in the immediate postoperative period and in decreasing doses later and for several months. Hyperpyrexia sometimes occurs within the first few days after operation and is treated by cold packs and aspirin to reduce the temperature, and by intravenous glucose and Lugol's solution to decrease any toxicity. Typical thyroid crises are seen very rarely when the patient has been well prepared.

The convalescence should not be hurried. It usually takes several months before the full benefit of subtotal thyroidectomy is obtained. And the patient should be kept under follow-up observation for a long time.

APPRAISAL OF RESULTS

In the great majority of the cases, the régime outlined in this paper will be followed by a more or less complete subjective cure. Nevertheless, in the great majority of instances, most of the demonstrable preceding objective symptoms, such as exophthalmos and tremor, can be demonstrated postoperatively to some degree. There also continues some of the underlying potentiality for nervous disturbances which should be taken as a warning that, even if the patient is apparently subjectively cured, any undue and extraordinary stimulus can cause a recurrence of symptoms. For this reason a searching inquiry into the possible causative factors which produced the illness originally should be made with the object of eliminating this from the patient's life. In this regard, the home and business influence and atmosphere is of paramount importance.

In observing the patient after operation, the determination of the basal metabolic rate should not be made for at least one month after discharge of the patient from the hospital. It is preferable that this should fall to slightly below normal.

Recurrences of symptoms occur in a small proportion of the cases—probably 10 to 15 per cent. These recurrences are based upon physical changes associated (1) with an insufficient removal of thyroid gland substances, and/or (2) with a hyperplasia and/or hypertrophy of the part of the gland left; or they are based upon undemonstrable biological chemical changes, either in the part of the gland left or in other glands of the endocrine system, notably the pituitary. Not always is there any increase in the basal metabolic rate; although there are cases, especially when there is enlargement of the stump of the gland, in which the metabolic rate can rise to a height comparable to that preceding operation.

When a full blown recurrence of symptoms occurs, the patient should be put through a course exactly similar to that preceding the first operation and should then be re-operated upon and any excess of thyroid gland tissue should be removed. Sometimes the amount of residual thyroid tissue after subtotal thyroidectomy is small, but it has happened in my experience that the removal of even such small amounts has given good secondary results.

In other cases we are left with the therapeutic use of Lugol's solution with or without the use of radiotherapy. These are most difficult cases to handle and not always does success follow our efforts.

The most difficult group are those in whom, preceding the primary operation, the symptomatology had included outstanding psychotic symptoms. In all of my experience I have never seen one case in which these psychotic symptoms have disappeared completely. It sometimes happens that they are slightly lessened for a very short period but then they always have recurred. Good psychiatric treatment is indicated but the outlook for the disappearance of the psychotic symptoms is very poor.

SIMPLIFIED ASEPTIC GASTROJEJUNAL ANASTOMOSIS USING THE RANKIN CLAMP*

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IN this paper only that phase of technic in gastric resection will be considered which is concerned with restoration of gastrointestinal continuity.

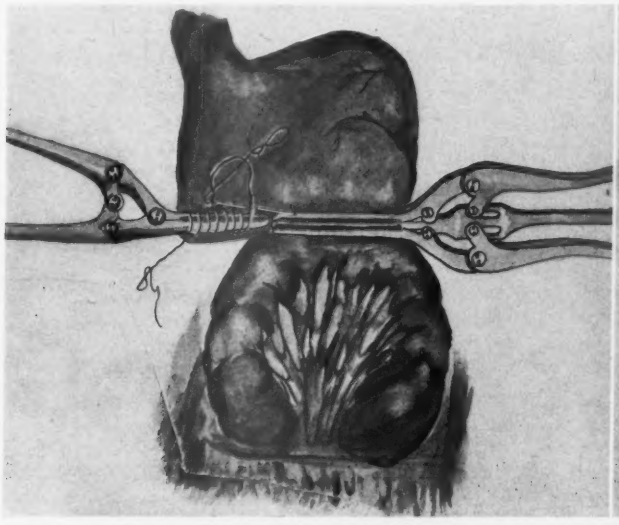

FIG. 1. Shows Rankin clamp applied transversely across stomach from the greater curvature side. Jejunal wall is held in opposite half of clamp with distal loop at the greater curvature. Right angle continuous suture is shown placed over Payr clamp which has been placed from the lesser curvature side with the tip approximating the tip of Rankin clamp.

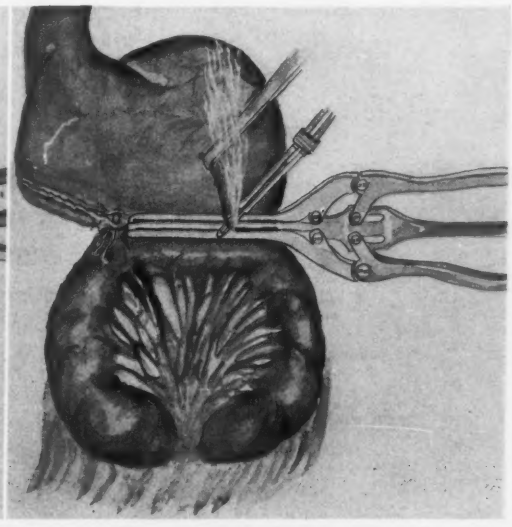

FIG. 2. Shows Payr clamp removed and crushed tissue has been inverted by right angle continuous suture reinforced by a second layer of interrupted mattress sutures. Strip of jejunum projecting above clamp is removed by cautery leaving, however, a narrow cuff of tissue attached to the clamp for cauterizing in order to effect complete hemostasis.

The application of the principle of aseptic anastomosis following resection of the stomach possesses definite merit provided simplicity of procedure is maintained. In considering the relative merit of closed as compared with open anastomosis the following factors should be considered:

Relative Asepsis. An open anastomosis even though carefully performed is inherently not an aseptic procedure. The so-called aseptic anastomosis performed over crushing clamps gives by comparison minimal contamination and for practical purposes is aseptic. Relative asepsis is particularly desired in cases of malignancy.

Hemostasis. It has been found in the experimental laboratory and in clinical use that the hemostatic effect obtained by crushing the stomach and jejunal wall with the Rankin and Payr clamps is entirely adequate to seal the vessels and avoid postoperative bleeding provided the suggestion of Hollman is followed of leaving a narrow cuff of tissue distal to the clamp which is cauterized to insure hemostasis. Several experimental anastomoses were performed without the use of the cautery until one fatality occurred because of obstruction at the stoma, the result of an adherent clot

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at the anastomotic site. This incident emphasized the possible hazard of even a small amount of bleeding and the importance of strict hemostasis.

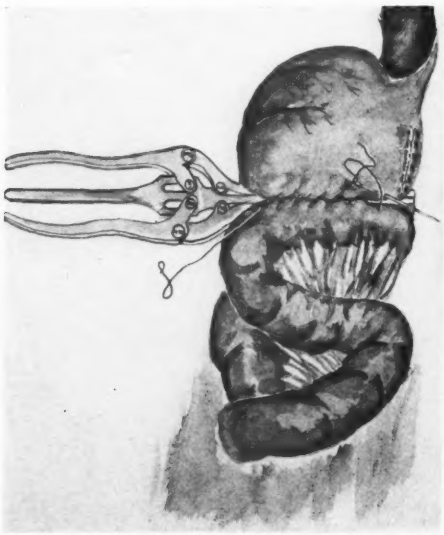

FIG. 3. Shows posterior surface of stomach and adjacent jejunum after rotation of Rankin clamp through an arc of 180 degrees. The right angle continuous approximating suture is shown partially completed. Note that stomach and jejunal wall fall together closely approximated which enables continuous approximating sutures to be placed without tension.

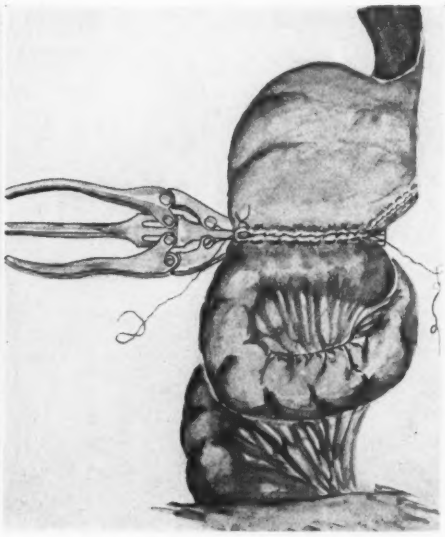

FIG. 4. Shows layer of interrupted mattress sutures placed to reinforce right angle continuous suture; posterior wall of stomach still presenting. Note ends of continuous suture left long.

Continuity of Tissues at the Gastrojejunal Stoma. Anastomosis over crushing clamps obtains adequate seroserous apposition with rapid re-establishment of continuity of the mucosal surface following sloughing of the crushed tissue. This restoration is fairly complete within a period of seven to fourteen days after anastomosis.

The Amount of Tissue Held in the Anastomotic Clamp Which Is Not Available for Resection. The amount of stomach tissue held in the rubber shod clamp in the usual open anastomosis and consequently not available for removal is not inconsiderable. In case of the crushing clamp it is minimal. Stomach and jejunal tissue is traumatized by rubber shod clamps used in an open anastomosis while this is obviated when crushing clamps are used as the tissue held within the grasp of the clamp sloughs.

TECHNIC

For optimum functioning of the newly formed gastroenteric stoma it is advisable to section the stomach transversely to the long axis of the body. This should obviate the necessity for an anastomosis between the proximal and distal jejunal loops. The Rankin clamp is applied to the gastric wall from the greater curvature side at the level to be resected. A small Payr clamp grasps the stomach from the lesser curvature side, the tip of which approximates the tip of the Rankin clamp. A long Payr clamp is placed distal to these two clamps and the stomach sectioned between with cautery leaving a narrow cuff on the proximal side. In case of an ulcer high on the lesser curvature the small Payr clamp may be applied with its base at the tip of the Rankin clamp and its tip at the lesser curvature. As an antecolic anastomosis is to be performed the opposite half of the clamp is applied to the antimesenteric border of the jejunum at a distance approximately 18 to 20 inches from the ligament of Trietz. Included within the grasp of the clamp should be a sufficient length of jejunum to oppose that portion of adjacent stomach wall within the grasp of

the opposite half of the clamp and only a sufficient depth to provide adequate jejunal opening for the stoma. In order to facilitate the placement of the jejunal wall within the grasp of the clamp two traction sutures or Allis forceps are placed on the antimesenteric border, to act as a guide at a distance equal to the length of bowel to be included. A right angle continuous suture of chromic catgut (No. 1 or 0) is placed over the Payr clamp. After removal of the clamp the suture is pulled taut, thus inverting the crushed tissue with approximation of serosa to serosa. This layer is reinforced with interrupted Halsted mattress sutures of Pagenstecher linen. The Rankin clamp is then rotated through 180 degrees vertical which presents the posterior surface of the stomach and adjacent jejunum in close proximity. A continuous right angle suture of chromic catgut No. 0 with an occasional back stitch, for the purpose of locking, is now placed which snugly and completely approximates, without tension, stomach to jejunum. A reinforcing layer of interrupted mattress sutures is now placed. The clamp is then rerotated so that the anterior surface of the stomach presents. A right angle continuous suture of chromic catgut is applied over the clamp which is then removed and the suture is drawn taut, inverting the crushed tissue and approximating serosal surfaces of stomach to jejunum. The ends of this suture are tied to the ends of the posterior continuous suture, cut short and inverted with mattress sutures. The anterior suture line is now reinforced with a layer of interrupted

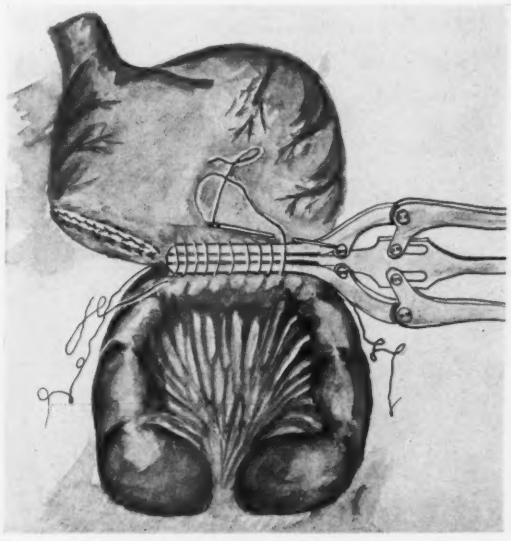

FIG. 5. Shows anterior surface of stomach presenting after rerotation of clamp. Right angle continuous suture has been placed over clamp.

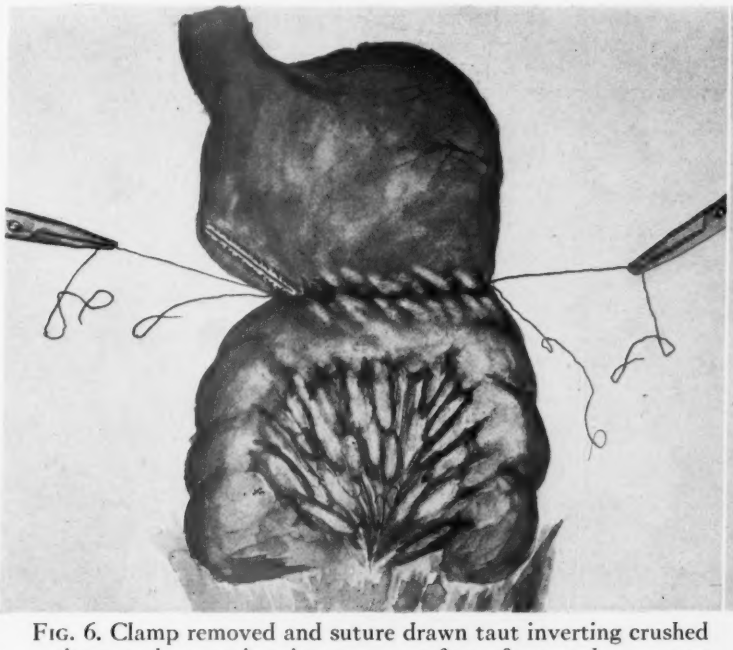

FIG. 6. Clamp removed and suture drawn taut inverting crushed tissue and approximating serous surface of stomach to serous surface of jejunum.

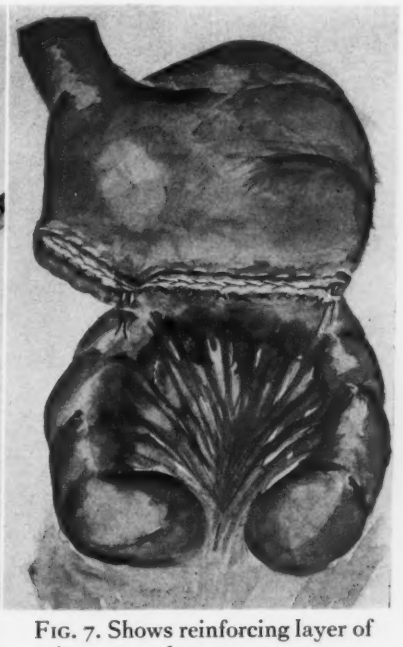

FIG. 7. Shows reinforcing layer of interrupted mattress sutures.

mattress sutures and the proximal jejunal loop may be approximated with interrupted sutures to the suture line extending to the lesser curvature. At each extremity of the stomach jejunal approximation reinforcing sutures may be placed, over which are tied a portion of omentum.

COMMENT

The Rankin clamp is considered well adapted to gastrojejunal anastomosis. The length of the crushing blades is sufficient to create an adequate gastrojejunal stoma, the crushing power of the clamp is adequate for hemostasis and the tissues to be sutured are held stabilized by the clamp in a favorable position for accurate suturing. Of special advantage is the fact that rotation of the clamp through a vertical are of 180 degrees presents in an anterior position the posterior surface of the stomach and adjacent jejunal wall which lay opposed in such a manner that two rows of sutures may be placed on the posterior aspect of the anastomosis without tension in this accessible anterior position. After removal of the clamp, only the outer anterior layer of interrupted sutures needs to be placed for completion of the anastomosis. The fact that all except a small portion of the anastomosis can be completed with the clamp in place is advantageous because its stabilizing effect facilitates the placement of sutures.

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TUBERCULOUS CERVICAL ADENITIS

TREATMENT BY IMMOBILIZATION

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DIMINUTION or arrest of the functional activity of an infected organ constitutes a cardinal principle in the treatment of tuberculosis. As such, it was established in the treatment of surgical tuberculosis early in the present century, and became applied successively to the hip, knee, ankle and elbow joints, to the joints of the vertebral column, by the use of plaster or other forms of splinting, and more recently by extra articular bone grafting; and reached its apotheosis in the induction of artificial pneumothorax and thoracoplasty in the treatment of pulmonary tuberculosis. Splinting of the neck has been advised as after-treatment following operation (Rose and Carless), and Calvé noted that in cases of Pott's disease of the cervical spine any associated glandular enlargement subsided as recovery of the bone infection progressed under plaster immobilization. However, so far as I can discover immobilization as a therapeutic measure *per se* has not been applied in the treatment of tuberculous glands of the neck.

In the following twenty-one examples, which comprise all the cases of this condition which have come under my care during the period, immobilization has been the essential feature of treatment. Where the enlargement was solid, i.e., due to caseation without liquefaction (eight cases), fixation by plaster alone was employed; where fluctuation was present but the skin remained healthy (three cases) the fixation was preceded by aspiration; where the skin was red and obviously infected, or where a discharging sinus was present, excision of the skin, curettage of the bed and closure by fine silk sutures with elimination of any pocket by deep suturing were employed, followed by the plaster cast. In every case, the glandular enlargement had disappeared at the close of the period noted and so far no recurrence has been found. In two cases of superficial tuberculous ulceration in the scar a few exposures to *x*-ray were required to complete healing. I can confirm Hamilton Bailey's comment that after a few weeks a large granulation area contracts down to a linear scar when immobilization of the neck is employed. Several of my sinus cases are left with a scar which is only discernible on close examination.

The method of applying the plaster case is as follows: The head having been washed with weak perchloride solution to remove dandruff, a pattrass of Gamgee tissue is cut to fit over the vertex and occiput, passing behind the ears. This is carried down to two inches below the nipple in front and to a corresponding level on the back. Laterally it stops short of the acromion process. A separate piece of Gamgee encircles the neck, protruding slightly beyond the chin with a square of jaconet below the mouth. A plaster case (Cellona) is cut in the dry of the same dimensions and shape as the pattrass, and a slab of six inch wide plaster bandage for the neck. The Gamgee is now tacked into position by a few stitches and the plaster case applied, special care being taken to build it up on the sides of the neck and under the chin. A few turns of plaster bandage are taken round the neck to consolidate this region. The axillae are left free so that movements of the arms are unimpeded, but the lower borders of the cast are held by a band of adhesive strap-

ping passed round the body. It is not necessary to use plaster for this purpose. The whole cast in white plaster has something of the appearance of the conventional Madonna's head-dress. For the purpose of concealing the inevitable soiling, it is advantageous to dye the Gamgee (I use red ink) and to paint the plaster when dry with a color of the patient's choosing. Care should be taken to see that the head is in the mean position, neither flexed or extended, while the cast is setting. It is surprising how little discomfort is complained of. After twenty-four hours movement of the jaw becomes sufficiently free to allow of mastication. If, however, the cast does not fit sufficiently snugly to prevent movement of the head in all directions, the patient experiences discomfort from the first, and a fresh cast must be applied.

The first cast remains *in situ* for four weeks and is then removed for examination. A new cast follows for another

TABLE I

CASES WITHOUT SECONDARY INFECTION

Case No.	Age	Sex	Year	Duration of Condition	Site and Size of Swelling	Period of Immobilization	(a) Previous Treatment (b) Preliminary Treatment	Year of Re-examination	Comment
1	30	F	1936	7 months	Anterior triangle; hen's egg	8 weeks	(a) Nil (b) curettage and closure	1939	Glands contained fluid pus; resulting scar not visible
3	16	F	1936	4 months	Anterior triangle; orange	14 weeks	(a) Nil (b) Tonsillectomy	1940	Serving in forces; no remaining evidence
4	9	M	1937	4 months	Posterior triangle	3 months	(a) U.V. light (b) Tonsillectomy	1940	No visible or palpable evidence
5	12	M	1937	3 months	Anterior triangle; golf ball	2 months	(a) U.V. Light 3 yrs. previously; recurrence (b) Nil	1939	No visible or palpable evidence.
7	20	F	1937	8 months	Posterior triangle chain; fluctuation; matted chain	13 weeks	(a) U.V. light and iodine injection (b) Aspiration	1940	No visible or palpable evidence. Sister of Case 6
8	17	M	1937	5 months	Anterior triangle; hen's egg	10 weeks	(a) U.V. light (b) Nil	1939	On active service 12 months
9	11	F	1937	6 months	Anterior triangle; small orange; no fluctuation	4 months	Nil	1939	No recurrence
12	5	F	1937	2 months	Anterior triangle; golf ball	10 weeks	U.V. Light	1939	No recurrence
13	7	M	1938	4 months	Anterior triangle; matted chain	14 weeks	(a) Nil (b) Aspiration	1940	Discharge persisted till 9th week
17	10	M	1938	2 months	Anterior triangle; walnut	7 weeks	(a) U.V. light (b) Nil	1939	No recurrence
18	17	F	1938	5 months	Posterior triangle; mass occupying whole space	10 weeks recurrence 3 weeks later. (b) 16 weeks.	(a) Iodine inunction (b) Nil	1941	Immobilisation discontinued too early; latest examination shows fibrous nodules only: on munition work
19	4	F	1938	6 weeks	Anterior triangle; hazel nut	7 weeks	(a) Nil (b) Nil	1939	No recurrence.

TABLE II

CASES WITH SECONDARY INFECTION

Case No.	Age	Sex	Year	Duration of condition	Site and Size of Swelling	Period of Immobilization	(a) Previous Treatment (b) Preliminary Treatment	Year of Re-examination	Comment
10	18	F	1937	11 months	Supra clavicular sinus	15 weeks	(a) Nil (b) Curettage	1941	No recurrence in neck but development of TB ankle in 1940
11	12	F	1938	2 months	Anterior triangle; abscesses with secondary infection	6 weeks	(a) Iodine inunction (b)Tonsillectomy; excision of infected skin. Curettage and closure	1940	No recurrence
15	15	M	1938	3 months	Anterior triangle sinus	11 weeks	(a) Aspiration and injection Formalin. ? (b) Curettage and closure	1940	No recurrence
14	9	M	1939	12 months	Posterior triangle r. axilla; multiple sinuses	20 weeks	(a) Nil beyond dressings (b) Curettage; abduction plaster combined with neck immobilisation	1940	No evidence of activity after 14 months; child evacuated
15a	10	F	1939	5 months	Anterior triangle infected abscess	9 weeks	(a) U.V. light: (b) Curettage; Bipp closure	1941	No recurrence, scar barely visible
16	35	M	1940	18 years	Posterior triangle; three sinuses	17 weeks	(a) Many forms including sanatorium (b) curettage	1941	Holds an important munition post; sinuses have remained closed for 15 months
2	8/12	F	1936	5 months	Anterior triangle and parotid area; sinuses	18 weeks	(a) Nil (b) Curettage and closure; Bipp	1939	Discharge up to 12 weeks. No evidence beyond scars, which are very inconspicuous
6	13	M	1937	?3 years	Anterior triangle; puckered sinuses	12 weeks	(a) 3 courses U.V. light (b) tonsillectomy; curettage and closure Bipp	1938	Had remained healed at last examination
20	49	F	1939 1941	at least 40 years	(1) Parotid area posterior triangle (2) Anterior triangle, multiple sinuses	(1) 11 weeks (2) 12 weeks	(a) Many forms (b) Curettage and closure (partial)	1941	Suffered all her life from discharging sinuses, which broke out with each pregnancy; parotid and anterior triangle; sinuses had remained healed for 22 months, when posterior triangle sinuses appeared: these are now healed

Cases No. 15 and 15a are brother and sister.

period of four weeks. If by that time the glandular enlargement has become reduced to a series of small nodules, a thick bandage of Unna's paste, reinforced at the sides with cardboard, is worn for three or four weeks longer, by which time only minute fibrous nodes are with difficulty palpable.

I am aware that a total of twenty-one cases is a somewhat small series on which to base a method of treatment; but I report it for the consideration of those who have large numbers of such cases to treat, in the belief that it is founded on a sound principle, is extremely simple in application and gives at least as much prospect of success as any of the numerous methods of treatment employed up to the present.

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The tomograph, an instrument by which roentgenologists can visualize and localize structures and foreign bodies in three dimensions, should be part of the equipment of every base hospital.

MANAGEMENT OF TUMORS OF THE BREAST

WITH SPECIAL EMPHASIS ON THE PROBLEM OF CANCER OF THE BREAST

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CONSTITUTING as they do almost 20 per cent[1] of the diagnostic and therapeutic problems at most tumor clinics, little apology need be given for another study of mammary neoplasms. Certainly periodic revisions in the light of current advances may well serve to augment life salvage. This paper is based in part on conclusions derived from our experience at the Brooklyn Cancer Institute since 1935, during which time a total of 351 cases of carcinoma of the breast in all stages presented themselves for treatment and is derived to some extent from a "Survey of End Results in Cancer Therapy," presented by the above authors at the June, 1940, Scientific Session of the American Medical Association. It also incorporates an attempted analytical correlation and evaluation of the trends, often widely divergent, predominant in the current clinical literature on the topic.

Benign Tumors of the Breast. Before consideration of the problem of cancer of the breast proper, the present disputatious status of their very nature and therapy must be indicated. The oft-discussed causal relationship between cystic disease of the breast and cancer of the breast must be dismissed as not conclusively settled at present, as noted in recent reviews. Benign tumors of the breast constitute 31 per cent of all such tumors. The only safe management for such lesions is diagnosis by biopsy, the ideal method of biopsy being a frozen section of a completely resected tumor.

Malignant Tumors of the Breast. Cancer of the breast constitutes approximately 14 per cent of all carcinoma, a figure equalled only by cancer of the cervix and exceeded solely by carcinoma of the stomach, the latter representing some 20 per cent of the cancer problem.[2] Since roughly 70 per cent of true tumors of the breast are malignant, the significance of cancer of the breast, although not our chief concern at the moment, requires discussion. Authorities vary considerably in their descriptive pathological groupings, but seem to concur in the statement that malignant lesions of the breast are of predominantly ductal origin. Contributory to the conflict of classification is the fact that the histological picture may differ in various areas and at various ages of the same tumor.[4] Closely scrutinized multiple serial sections in a given case of cancer of the breast, may, as demonstrated by Koppelman[5] and other workers reveal areas characteristically described as scirrhous, medullary, and comedocarcinoma within a single tumor mass. The authors have had ample opportunity to corroborate this viewpoint in their own series. Consequently, therefore, we agree with Wrenn[6] and others that aspiration biopsy is a procedure of problematical value, of inconclusive meaning when negative and not necessarily characteristic of the predominant cancer-cell type present when positive. Moreover, rather than resort to limited categories for descriptive purposes we utilize the chief pathological "nomenclatures" instead of "classifications" which best define the predominant tissue volume of the tumor under consideration.

As a further introductory keynote to the essentially unsettled nature of this phase of the problem of cancer is the fact that the therapeutic management of mammary cancer is likewise more controversial now than ever before.

Clinical Grouping of Cancer of the Breast. At the Brooklyn Cancer Institute Breast Clinic, the Steinthal classification has been adopted as the most satisfactory available. It is not an accurate pathological grouping, but rather a method, based on simple diagnostic procedures such as inspection and palpation, which permits prompt disposition as to the most appropriate further management as at present established. As stressed later, the factor apparently most profoundly influencing the number of five-year arrests is the percentage of Steinthal 1 cases treated in the series.[9] However, the fact that palpable axillary nodes, as demonstrated by Harrington,[10] of the Mayo Clinic, often prove nonmalignant must not escape consideration. About 50 per cent of these cases are found to be free of axillary cancer on microscopic examination.

Time Element in Cancer of the Breast. Even though it is an obvious fact that from the moment of its inception, the sooner a given cancer is eradicated the better the chance for cure and the smaller the opportunity for regional and distant spread, nevertheless overemphasis on the rôle of the time element must be guarded against. There has in recent years been increasingly in evidence a tendency to submit to the present mortality toll of cancer of the breast, in the hopeful expectation that the key to control of the disease lay in the not too far distant era when patients could be uniformly prevailed upon to present themselves with early minimal lesions. It cannot be too strongly emphasized that complacement acceptance of this fallacy will only detract from efforts to attack the problem of cancer of the breast along more effective and promising avenues. More general recognition instead of this pessimistic aphorism, that, "the sooner the patient with cancer of the breast seeks medical care, the sooner she dies," will, when it is properly interpreted, serve to stimulate the onslaught with renewed vigor against this scourge. Location of the tumor[11] and the fact that the overwhelming majority are of a highly malignant grade[12] are illustrative factors beyond our control which are as important as delay in determining the prognosis. Intrinsic tendency of the tumor to rapid growth and generalization is a factor too little appreciated.[13] Generally speaking, the patient with a rapidly growing early painful tumor, i.e., one with a highly malignant lesion is more apt to apply promptly for medical care than one with an indolent, slow-growing, relatively painless lump. Since a lapse of several weeks in the former case constitutes a grave threat in this more prevalent type of lesion than in the latter, wherever applicable immediate radical therapy must be instituted if we are to exact the utmost in potential life salvage from the clinical material at hand.

Controversial Claims in Therapy of Cancer of the Breast. The physician resorting to clinical literature as a guide to the proper management of a patient with cancer of the breast is confronted by a confusing array of claims and counterclaims concerning the merits of various modes of treatment, a situation hardly exclusive to this field of medicine. Errors common to the entire clinical domain are equally operative here, and a brief analysis of these factors as applicable to the problem of mammary cancer, and their contributory rôle as major underlying reasons for much of the current controversy prevalent, is herewith presented. For any given claim, a comparable conflicting claim differing by less than 5 per cent can be demonstrated. Radical surgery is the most widely reported form of therapy. Disparate results of this nature confuse the issue of what constitutes proper therapy, and are largely due to faulty statistical analysis. Differences in end results may depend on selection of cases as well as modes of treatment. For any given claim of percentage of five-

year survivals, a conflicting claim differing by less than 5 per cent has been reported in the literature. The lack of a demonstrable statistically valid advantage of any procedure over radical mastectomy indicates that it has as much to offer the patient as any other mode of treatment. Most authors conclude that radical mastectomy is the treatment of choice in cancer of the breast. Some claim that irradiation, in most instances postoperative, is beneficial, but do not proffer unassailable statistical proof.

Biometry and the Problem of Cancer of the Breast. Recent years have witnessed an increasing recognition of the significance of accurate biostatistical methods in the correct evaluation of clinical data. Clinicians, reluctant in the main because of inadequate familiarity with mathematical technics, are still somewhat too prone to rely exclusively on impressions gained from personal experience with quantitatively limited material. In due fairness, it is admissible that facility in methods of diagnosis and therapy can be gained only by extensive personal clinical experience. However, reliable conclusions as to the advantage of one proposed form of treatment over another are apt to require a greater body of data than can be amassed by the individual physician or surgeon, and consequently necessitate a pooling of clinical resources.

For a difference of 5 per cent to be statistically significant (i.e., due to specific modes of therapy rather than pure chance probability) unbiased samples of magnitudes greater than 5,000 to 7,500 in each group must be compared. In small series consistent differences exceeding 25 per cent are required to establish superiority of any given mode of treatment.[27]

It should be noted that treatment, whether surgical or radiological, is apparently the only sampling factor of a breast-cancer series that is at present controllable to any real extent. Until the very nature of the cancer problem is solved we cannot expect to influence the remaining determinants significantly. Obviously, to exact the maximum in life salvage from available material, optimum therapy must be applied.

IMPORTANT FACTORS IN RELATION TO END RESULTS

Natural Survival—The Untreated Patient. Before passing on to the consideration of results in cancer therapy, a natural yardstick, that is to say the duration of the untreated disease, must be defined. Doland[22] has shown that in the series of over one hundred patients with cancer of the breast, more than 20 per cent survived five years. To demonstrate the effectiveness of therapy, the average survival period of a suitably large series must appreciably exceed forty months.[34]

Stage of Lesion. Liljencrantz[9] has shown that the factor most profoundly influencing the number of five-year arrests obtained in a series of mammary carcinoma is the percentage of early or Steinthal I cases treated. Adopting his figures, the following comparison of statistics proves illuminating:

RELATION OF PERCENTAGE OF STEINTHAL I CASES TO CLINICAL END RESULTS

Author	Total Cases	Five Year Arrests, Per Cent	Percentage Steinthal I of Total Cases	Treatment
Lewis and Rienhoff....	950	18	14	Radical mastectomy
Harrington...	2879	29	22.5	Radical mastectomy
Bartlett.....	158	30	34	Radical mastectomy
Lee.....	217	41	42	Mastectomy plus radiation
Pfahler.....	343	48	35	Mastectomy plus radiation

Although at first sight these end results might be construed as due to improvement in the therapeutic approach, utilization of the few statistical criteria mentioned above establishes the fact that sampling differences alone are so great as to account for any discrepancy in outcome of the various series.

Pathology of Lesion and Radiation Sensitivity. Broders has arranged tumors of the

breast into groups, varying from relatively differentiated and less malignant to highly anaplastic and malignant. Without entering into the controversy concerning the validity of grading, its significance in relation to the specific problem of cancer of the breast assumes no great degree of importance from the author's very figures which indicate that from the outset roughly nine-tenths of cancers of the breast are highly malignant. Whatever the relationship between various grades of epitheliomas and radiation sensitivity, claims that cancers of the breast are responsively radiation-sensitive are sparse indeed. It is difficult to correlate the admitted radioresistance tumors of the breast with the radiation curability nonetheless claimed by some workers in the field. It need only be pointed out that thoroughgoing search of the voluminous literature on the subject failed to reveal up to the present any paper postulating the advantages of irradiation, whether exclusively or in combination with surgery, which abided by the elementary statistical criteria of reliability heretofore discussed.

BRODER'S CLASSIFICATION OF BREAST

		No. Cases	Per Cent Cases	Per Cent Metastases
Grade I....	.....	129	3.8	7.8
Grade II...	.....	427	12.7	42.9
Grade III..	85 per cent highly malignant	1091	32.4	71.7
Grade IV...	Greater malignancy Higher degree of anaplasia	1721	51.1	88.3

There is no conclusive evidence to indicate greater radiation sensitivity of particular histologic types of cancer of the breast.[35] Grading cancer of the breast according to radiosensitivity is unreliable.[37]

METASTASIS AND RECURRENCE

For their practical relationship to the actual curative management of cancer of the breast, metastasis and recurrences need only brief discussion. Generalized dissemination is a phase of the illness in which nothing but palliation of various degrees of efficacy can at present be offered. Liljencrantz[9] has emphasized a point with which we are in entire accordance: that cancer of the breast spreads more widely than other epithelial tumors. The lungs, liver, bones, regional nodes, skin, adrenals, peritoneum and brain are in roughly that order, the organs most affected.[54] Splenic and ovarian involvement are not uncommon.[55] Osseous metastases can often be symptomatically controlled for long periods by radiation therapy. The average interval between operation and recurrence is two years for most sites.[38] Distant metastases occur more often independently of local recurrences. Local recurrences suggest incomplete extirpation.

The curable case may be simply defined as one in which the process is confined to a removable breast and resectable avenues of extension. Blood-borne extension, is, of course, irretrievable. The supraclavicular, retrosternal, and mediastinal lymph nodes, once involved, are inaccessible. However, axillary, subscapular, subpectoral, and epigastric nodes may be extirpated in the hope, occasionally justified, that extension has not progressed beyond them. Hicken[40] has recently published mammographic studies concerning lactiferous ducts as an overlooked extension pathway for cancer of the breast. Widespread ramifications of the ductal system with frequent axillary, subpectoral, midsternal, and epigastric prolongations were traced, serving as further argument in favor of radical excision of these tumors.

In the hope that resective procedures would thereby be facilitated and consequently more thorough, with direct visualization of regional lymphatics, the authors have carried out intravital contrast staining with several vital blue dyes in a few cases prior to operation with promising results thus far. Preoperative lymphography, a novel departure to our knowledge, gives greater assurance that effective radical resection has been accomplished. On completion of current studies of the value of this technic in such procedures

as block dissections of the neck and axillary and inguinal lymphatic extirpation, this matter will be presented in detail.

TREATMENT AND END RESULTS

The following review of 351 cases seen since 1935 at the Brooklyn Cancer Institute points out the fact that our experience, in general, conforms to that reported by the majority of our co-workers. Inasmuch as a sufficiently long interval has not elapsed to speak of definite "cures" or five-year survival percentages, we have referred to those cases which are clinically free of cancer at the present writing as "controlled" cases.

The average age of the patients among the 351 treated was 52.6 years. Six males are included in the study and 345 females. In the Steinthal I cases the average delay was 8.3 months. In the Steinthal II cases, the average period of delay was 9.6 months. There were many reasons for the delay, the most frequent being ignorance, fear of operation, medical mismanagement, senility and sociological status.

Sixty-five per cent of the cases showed duct carcinoma; 15 per cent adenocarcinoma and 20 per cent medullary carcinoma. At the time of admission, 15 per cent of the cases were Steinthal I; 50 per cent Steinthal II and 35 per cent Steinthal III.

Clinically, 60 per cent showed spread into the axillary glands; 20 per cent into the skin; 8 per cent into the ribs and sternum and 10 per cent into the supraclavicular glands.

On postmortem examination, the following metastases were noted: 15 per cent, pleura and lungs; 40 per cent, osseous; 30 per cent, liver and peritoneal cavity; 12 per cent, brain and skull.

Seventy cases (20 per cent) received primary therapy. Fifty-six radical mastectomies were performed with only one (less than 2 per cent) operative death; 157 cases (45 per cent) received secondary therapy; 122 cases (35 per cent) received palliative therapy. Of the 227 cases receiving treatment, 30 per cent may be considered controlled and 70 per cent unimproved.

Breast Clinic Routine—Brooklyn Cancer Institute

1. History and physical on special breast clinic chart. General medical history and physical.
2. Local breast findings to be entered on breast chart. Transillumination, roentgen mammography if indicated.
3. Routine hemoglobin, urine, Wassermann, blood typing (if preoperative).
4. Aspiration biopsy, if indicated, in State II or III. Localized nodularities, presumably malignant fall into Stage I, to receive only immediately preoperative frozen section biopsies.
5. Routine photograph.
6. Chest plate; skeletal radiography or mammography where indicated.
7. Radiation therapy consultation.
8. Referring physician or institution to be advised of progress of case.

OPERATIVE PROCEDURE

At Brooklyn Cancer Institute, radical mastectomy is considered the operative procedure of choice. In view of the existent controversy concerning the possible superiority of other methods of treatment, we have drawn up the following list of reasons, which pending establishment of definite evidence to the contrary, we like to consider both logical and persuasive:

Most cancers of the breast are relatively radioresistant.

The lactiferous ducts have widespread ramifications.

There are extensive pathways for lymphatic extension.

The incidence of local and axillary recurrence as a cause of death is relatively low.

Although axillary metastases influence prognosis adversely,[15] 50 per cent of five-year survivals had axillary metastases.

Fifty per cent of the enlarged axillary nodes in cancer of the breast are nonmalignant.[10]

The breast is easily removed; there is a low (2 per cent) mortality, without loss of essential function.

The potential life salvage is great, prior to distant metastases.

There is a lack of statistically valid evidence to demonstrate the superiority of other modes of therapy.

Adequate case series' totals (i.e., thousands) demonstrate that there is an advantage over the untreated group.

As pointed out by Maddock[42] and his co-workers, the blood loss in radical mastectomy generally exceeds that of most other major surgical procedures and is particularly apt to precipitate surgical shock. We have modified the standard procedure in a few details to minimize hemorrhage, and consequent operative mortality and morbidity, as well as to ensure radical extirpation as meticulously as possible.

The surgical technics described by various authors suffer no less from lack of agreement as to optimum procedures than the foregoing aspects of breast cancer diagnosis and management. Inasmuch as no trustworthy improvement in results has been reported for any given procedure, it can be assumed that they all accomplish in effect the same thing. Since the surgical anatomy has been amply described elsewhere, we shall stress only those features which we believe to have been given inadequate attention.

Concerning the fifty-odd incisions described,[53] we can only point out that such surgeons as Crile[43] and Lewis and Rienhoff[44] are in conflict concerning the very status of so basic a principle as the proper amount of integument to be excised. The former believes wide skin excision unimportant, the latter hold that greater skin sacrifice lessens the incidence of postoperative local recurrence. We are somewhat inclined to agree with this last doctrine, and have found the Deaver incision[49] most suitable for general purposes and one that readily lands itself to necessary modification, e.g., in removal of an involved axillary mammary gland process. Proper identification and ligation of the thoraco-acromial trunk, as it perforates the costocoracoid membrane medial to the tendon of the pectoralis minor, is of paramount importance in reducing blood loss. On retracting the pectoral muscles and tensing their slips of origin, we place clamps tangentially, close to the chest wall, before severing the interdigitations and in this way avoid the danger of having a bleeding vessel retract intercostally. In a random dozen operative descriptions, half the authors are found to complete the axillary dissection first,[45,49,50,51,11] while the remainder,[46,47,48,19,52,3] postpone this until the pectoral muscles have been severed. Since no anatomical fascial continuity exists between the epigastric portion of the rectus sheath, which we resect routinely, and the prolongations of the axillary fascia to the coracobrachialis muscle and brachial plexus, we make it a practice to remove the breast and underlying pectoral muscles *en masse* in a caudal and medial direction, to minimize surgical dissemination of malignant cells, and return to complete the axillary dissection as a secondary procedure. Unless cancerous involvement counterdicts, the cephalic vein, subscapular nerves and vessels, and long thoracic nerve are preserved intact. The causal relationship of any step in the operative procedure to postoperative edema, is, to our minds, still indefinite. Where necessary, therefore, the axillary vein is sacrificed, without apparently predisposing to such edema to any greater extent. The serratus, latissimus dorsi and subscapular fascia are cleaned and the brachial plexus and artery denuded before closure. Our preference has been for electrosurgical hemostasis in the first stage of the operation, resorting to sharp dissection in the axilla. If necessary in closure, skin grafts are utilized. Careful skin approximation seems to us to hasten postoperative healing considerably, and is allowed as long an interval as this painstaking procedure requires.

SUMMARY AND CONCLUSIONS

An analytical survey of 351 cases of cancer of the breast seen at Brooklyn

Cancer Institute since 1935 is presented in conjunction with a critical evaluation of end results.

The management of cancer of the breast is more controversial at present than at any other period. The underlying factors for this state of affairs are analyzed in an attempt to arrive at an optimum routine for the treatment of operable cases.

Several technical operative features are discussed in relation to the prevention of undue hemorrhage, postoperative morbidity and recurrence.

Reported five-year survivals vary roughly from 30 to 40 per cent without statistically indisputable evidence that such differences are due to specific modes of therapy. The fact most profoundly influencing the number of five-year arrests is apparently the percentage of early or Steinthal 1 cases treated in such series. Valid improvement over the 30 per cent five-year survival rate reported forty years ago after radical mastectomy alone has not been biometrically established. The essential determinants, then as now, appear to be the rate of preoperative growth and the tendency to localization or metastasis of a given cancer of the breast.

The five-year survival rate for untreated cases is about 20 per cent. However, all these survivors have active lesions. After radical amputation roughly one-third of the patients with cancer of the breast survive, demonstrating a statistically significant advantage. In reliably large series of cases the sole major determining factor for success within our control appears to be surgery.

Thirty to 40 per cent of patients with cancer of the breast are demonstrably aided by present methods of treatment. Sixty to 70 per cent are doomed to failure. The baffling intrinsic factors predicate failure in some two-thirds of all cases of cancer. In the 30 per cent which are benefited, the percentage of Steinthal 1 and radical mastectomy are the major factors for success.

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ONE-STAGE RADICAL RESECTION OF THE RECTUM BY MODIFIED LLOYD-DAVIES TECHNIC*

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ONE-STAGE radical resection of the rectum and rectosigmoid colon has become widely accepted as the procedure of choice in the treatment of carcinoma of the rectum. The margin of operability is ever widening and mortality statistics are well within a satisfactory limit for cancer surgery.

The technic most commonly employed today by surgeons throughout the world is that of Miles. This procedure has undergone certain refinements in technic both from the very wide experience of Mr. Miles himself and that of various large clinics in this country.

However, it is well known to surgeons that there are certain shortcomings to the Miles procedure in some cases, shortcomings which make the technic extremely difficult and which occasionally actually jeopardize the patient's chances. This is especially true in short, stocky, male individuals possessing a short mesosigmoid and in whom it is extremely difficult to visualize fully the dissection of the upper rectum through the laparotomy wound. Furthermore, after the sigmoid has been cut across and the proximal loop brought through the gridiron incision, it is necessary to pack the dissected specimen into the pelvis and close the pelvic peritoneum over the mass. This latter step is almost impossible in patients with a narrow pelvis, or in situations in which it is necessary to remove a considerable portion of peritoneum with the tumor.

The purpose of this communication is to recommend that the surgeon have in mind other procedures, which, if properly employed, can obviate certain of these technical difficulties. We should like to recommend for more popular use the simultaneous one-stage perineo-abdominal resection of O. V. Lloyd-Davies as modified by us. In this procedure the dissection is carried out simultaneously through the abdominal and the perineal routes.

We have found that the simultaneous resection combines the advantages of the Miles abdominoperineal resection with those of the Gabriel perineo-abdominal resection without appreciably carrying over the disadvantages of either procedure. This feature was particularly appealing to one of us (H. L.) who was privileged to observe and assist Mr. Lloyd-Davies on several occasions in 1939.

Before describing the technic in detail, it might be advantageous to review briefly the essential steps in both the Miles and the Gabriel operations in order to emphasize the disadvantages in certain phases.

In performing the Miles one-stage abdominoperineal resection of the rectum and rectosigmoid colon, one usually enters the abdominal wall through a low left or right paramedian incision. After determining the extent of the lesion and the possible spread to the liver or other organs, the superior hemorrhoidal and a portion of the sigmoid vessels are ligated, the pelvic peritoneum is dissected laterally from the base of the mesentery, and the rectosigmoid colon is dissected downward to include sectioning of the suspensory ligaments. The sigmoid colon is then cut across between the blades of a de Martel clamp by means of electrocautery. The proximal loop is brought out through a left gridiron incision, and the specimen to be removed

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is then packed snugly into the retroperitoneal pelvic space. The peritoneal pelvic floor is then closed by suturing the previously dissected leaves of the peritoneum over this mass. After closing the abdominal wall the patient is turned on his side and the perineal stage of the operation is performed. This consists of disarticulating the coccyx, dissecting out the lower rectum from its surrounding structures and removing the specimen from below. The perineal defect is then lined with oiled silk and packed with gauze. Partial closure of the perineal wound is usually carried out.

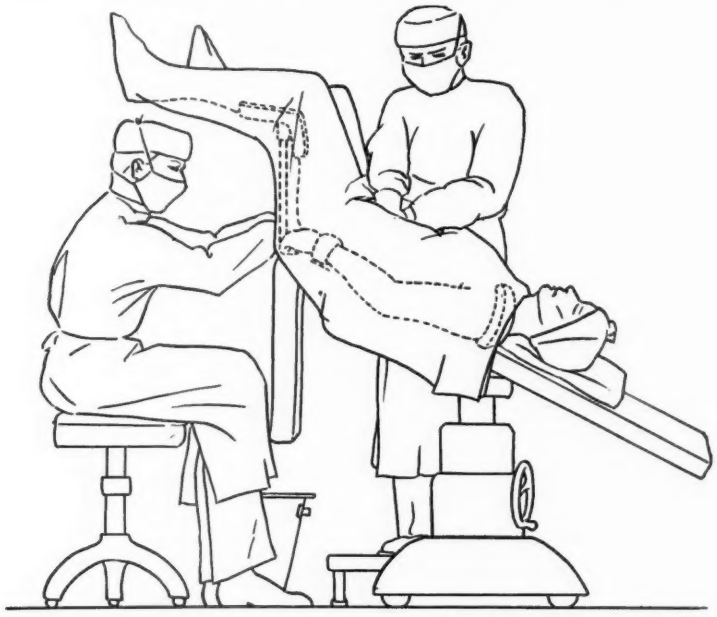

FIG. 1. Diagram of position of patient and operators in one-stage simultaneous perineo-abdominal resection of the rectum and rectosigmoid colon. Not shown are one assistant for the perineal operator and one or two assistants for the abdominal operator. For modification of the operation when only one surgeon operates, see text.

As indicated above, it is difficult, indeed impossible in some cases, to acquire a satisfactory closure of the pelvic peritoneum over the pelvic space which is crowded with the specimen, even though considerable time is spent in freeing the peritoneum laterally. Extra precautions must be taken in this dissection to prevent injury to the ureters especially the left. Perineal herniation may result if this closure is not satisfactory. Occasionally, the specimen must be fragmented to reduce its mass. This is especially undesirable since the carcinoma itself may be cut into. Furthermore it ruins the pathological specimen for study.

It is true that the use of electrocautery and the de Martel clamp or one of its modifications have largely minimized the risks associated with cutting across the colon in the open peritoneal cavity. Nevertheless, peritonitis and wound infection are still frequent lethal factors in mortality figures following the Miles operation. It is likewise true that shock, which usually occurs in the latter stages of the operation, particularly when the patient is turned on his side for the perineal excision, is today prevented in most instances by blood transfusion, saline infusion or both. If such measures are not taken during the operation, shock is almost invariably present at the completion of the perineal phase. However, the length of the procedure in some cases will result in shock, regardless of the precautions taken.

The Gabriel one-stage perioneo-abdominal operation overcomes the disadvantages

of the Miles procedure to some extent. Gabriel's technic consists, essentially, in first exploring the abdomen through a low right paramedian incision, temporarily closing the wound over an anchored gauze dressing, turning the patient on his side for the perineal excision, and finally completing the excision through the original abdominal incision. The perineal dissection is thus carried out first. It consists in closing the anus by two purse-string sutures and carrying out the dissection in the usual manner after disarticulation of the coccyx. The freed rectum and anus are tied firmly in a sterile glove. The peritoneum is incised from below and the rectum is pushed up into the pelvis. The perineal wound is then packed and partially closed. The patient is then replaced in the Trendelenburg position and the abdominal wound re-opened. After dividing the vascular pedicle, the entire specimen is delivered through a left gridiron incision, thus allowing the closure of the pelvic peritoneum over an *empty* pelvis. The abdominal wound is then closed and dressed. The specimen is finally removed by cautery between clamps *outside* the abdomen after all dressings are firmly in place.

It must be admitted that Gabriel has done away with several of the drawbacks encountered in the Miles operation. By doing the perineal excision early in the operation, shock is largely eliminated. By avoiding intraperitoneal section of the colon and delivering the specimen unopened and intact through the colostomy incision, the risk of peritonitis is conceivably minimized. Furthermore, it is often possible to resect a longer segment of left colon by this procedure than in the Miles operation, thus enabling the surgeon to remove a greater number of tumor-bearing lymph nodes.

Despite these apparent advantages of the Gabriel technic, there remain several distinct disadvantages. The patient must be turned at least once during the operation and sometimes twice. Moreover, it is often necessary to return to the perineal wound to be sure of hemostasis and proper packing after the abdomen has been closed, thus necessitating either a second turn or placing the patient in the lithotomy position. Such manipulation of the position of the patient during anesthesia is known to increase surgical shock. Even in the hands of Gabriel himself, the operation is an extremely time consuming procedure. The type of patient in whom radical cancer surgery is performed, is not often a suitable risk for long, deep anesthesia, despite the great improvements in modern technic. A disadvantage common to both the Miles and Gabriel operations, is that the perineal dissection is carried out in the left lateral position. This carries with it certain limitations of good exposure and accuracy in dissection. The pelvic tissues on either side of the rectum are not placed in the same degree of stretch.

We are of the opinion that the simultaneous one-stage perineo-abdominal resection of Lloyd-Davies has certain distinct advantages over either of the above described technics in certain cases. Its advantages will be brought out as the steps in technic are described below.

TECHNIC

Anesthesia is induced with the patient lying flat on his back. After consciousness is lost, the table is tilted to a mild Trendelenburg position. The legs are then brought up and adjusted by means of stirrups or knee rests, to a mild lithotomy position. The table is broken in the usual manner for perineal procedures. The buttocks are brought well beyond the edge of the table. A small pad or sandbag is then placed under the sacrum to further elevate the coccygeal region.

Lloyd-Davies described a special type of knee rest which could be adjusted to hold the knees and legs in any desired position. However, we have found that almost any type of sturdy knee or leg support which will hold the legs separated without throwing the thighs back onto the abdomen is satisfactory. The aim in fixing

the patient's position is to allow enough room for adequate exposure from above as well as good vision and exposure from

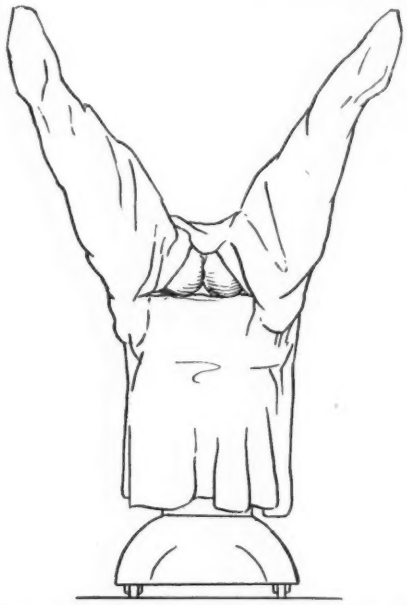

FIG. 2. Perineal view of patient, showing adequacy of exposure.

the perineal side. One must place the sacral sandbag at the point of greatest convexity of the sacrum. If the sandbag is placed too high, the pelvis will tilt away from the abdominal operator, whereas if it is placed too low, there is inadequate exposure of the coccyx. In males the penis and scrotum are kept out of the way by strapping them to the right thigh with adhesive plaster. If an indwelling catheter has been inserted, it, too, is strapped to the right thigh.

Shoulder braces are used to prevent the patient from sliding down on the table. After the position has been carefully checked for comfortable operating from both the perineal and abdominal approaches, the abdominal skin and perineal skin are simultaneously prepared with a mild antiseptic solution. The patient is then draped, allowing for a low abdominal operating field as well as an adequate perineal field. If two surgeons of experience work together, one works from the abdominal approach and the other from the perineal approach simultaneously.

The procedure, as we have carried it out, consists in first opening the abdomen in the usual manner for thorough exploration. If the lesion is found operable, the type of operative procedure to follow will depend upon the size, location and involvement of the lesion. If an abdominoperineal operation of the Miles type is decided upon, the abdominal operator carries out the usual steps as previously outlined, while the perineal operator begins the section from below. The specimen is then removed through the perineal opening as soon as it is dissected free and the bowel severed, thus allowing closure of the peritoneum over an *empty* pelvis. Furthermore, the patient need at no time be turned. The procedure, when simultaneously carried out, can be done comfortably within an hour.

If a perineo-abdominal procedure of the Gabriel type is decided upon because of a short mesosigmoid or deep attachments of the lesion in the pelvis, the perineal operator proceeds as before, while the abdominal operator ligates the vascular pedicle. After dissecting out the lower rectum the perineal operator ties a sterile glove over the closed anus for deliverance into the peritoneal cavity. In the perineo-abdominal procedure the peritoneum is best opened from below, in which case there is considerably less risk in injuring the left ureter.

Our practice has been to have the abdominal operator place a finger in the pouch of Douglas at the request of the perineal operator after the latter has reached this point in his dissection. The peritoneum is thereby easily identified, opened from below, and incised around the rectum. In this particular phase of the dissection, it is most advantageous in certain types of fixed tumors to be able to view the dissection from above as well as below.

The synchronization of both operators in dissecting this fixed portion of the rectum saves considerable time and allows for accuracy in dissection, which otherwise might not be attained. The specimen is

then brought out intact through a left gridiron incision, and closure of the pelvic peritoneum and abdominal wall are carried out as in the Gabriel technic. The specimen is removed after the abdominal dressings have been applied.

We should like to emphasize that it is not essential to have two well trained operators, provided two assistants are available. For example, the operator can transfer his position from the abdominal exposure to the perineal exposure at will, provided he carries out the accepted procedure of changing gown and gloves. This need not essentially prolong the duration of the operation.

Once the operation has been started with the patient in the above described position, whether there be one or two experienced operators, or whether the specimen is removed from above or below, certain advantages have been apparent to us:

1. The pelvic peritoneum is always closed over an *empty* pelvis.

2. The perirectal tissues are placed on a bilaterally equal stretch for easy identification and accurate dissection from below.

3. Once the preoperative position is fixed, the patient is at no time turned or twisted into another position during the operation.

4. Full vision from both above and below makes for more accurate dissection and facilitates the removal of low lying lesions.

5. The operation can be comfortably completed in about an hour regardless of the type of dissection decided upon.

6. We believe that a more widespread use of this combined technic may broaden the field of operability still further in the treatment of carcinoma of the rectum.

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TECHNIC OF SAPHENOUS LIGATION

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THE physiopathology of varicose veins and the dysfunction of the saphenous system of the leg, when its valves are congenitally defective or acquire incompetence, have for centuries been thoroughly understood. Yet it is surprising that the operation of saphenous ligation—so simple, and often so spectacular in its results—did not attain its due popularity until the last decade or two. While the operation for interrupting the saphenous backflow in order to alleviate venous stasis in the lower extremity is a comparatively simple procedure, there is, as is usually the case, a right way and a wrong way of achieving this result. The only proper surgical method is always that which, by the simplest possible maneuver and in the shortest period of time, promises the patient the maximum of benefit. The improper method is the one which consumes hours of fumbling, and after all is done, the surgeon hopes that he has not tied off the femoral artery instead of the saphenous vein, an accident, which despite its absence from the literature, has more than once taken place.

Apart from the basic knowledge of the fundamentals of surgical technic, the successful execution of this or any other operative procedure depends upon two conditions. The first condition is one of proper *geography*, the second, of positive and planned *strategy*. Obviously, a thorough knowledge of the anatomy of the region is one of the chief prerequisites of good surgery. The same object can be found more easily in one's own home than in the neighbor's home simply because there, one is more acquainted with the relations of the various objects. The object would also eventually be found at the neighbor's home but only after a great waste of time and expenditure of energy; and in surgery, this can cause much damage.

With a lucid picture of the regional anatomy in mind, the surgeon can embark upon a preconceived, deliberate and explicit strategy of action in which the operation is divided into simple, consecutive steps to be gone over from A to Z.

As far as the geography of this particular region is concerned, the inguinal ligament which serves the surgeon so well in delineating the anatomical relations in a hernia operation, once more helps him to orient himself and become acquainted with the location and the relationships of the saphenofemoral region. The anterior superior spine of the ilium and the pubic tubercle are identified, and the inguinal ligament, hanging hammock-like between these two points is thus visualized. The midpoint of the inguinal ligament is palpated, and the femoral artery is felt pulsating at that point as it emerges from under it to course downward and medially into the thigh. Medial to the artery lies the femoral vein into the almost terminal portion of which the saphenous empties. In this connection, it is worth noting that the saphenofemoral junction is much higher than most atlases and books on anatomy picture it to be.

The long saphenous vein starts from the medial end of the dorsal venous arch of the foot and climbs upward anterior to the internal maleolus of the tibia. It continues to climb between the skin and deep fascia up the medial aspect of the leg, knee and thigh until eventually it winds anteriorly in the upper thigh, pierces the deep fascia and widens into the saphenous ampulla to empty into the femoral vein. Before it passes through the fossa ovale to empty

into the femoral vein, three tributaries empty into it; the superficial external pudenal medially, the superficial epigastric anteriorly, and the superficial circumflex iliac laterally. Any two or the entire three may join in one trunk before emptying into it. Thus the saphenous vein receives its three uppermost branches, pierces the deep fascia, widens into the saphenous ampulla and empties into the femoral vein, all within an area the size of a nickel piece. That spot is located half an inch medial and below the junction of the medial and middle thirds of the inguinal ligament.

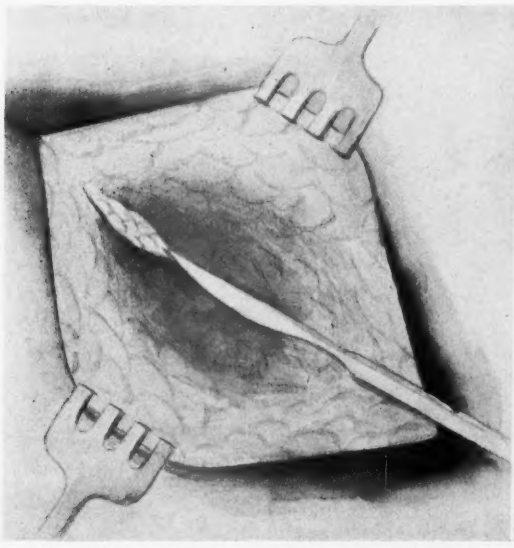

Fig. 1. Skin is separated and superficial fascia incised.

Fig. 2. Long saphenous vein exposed and tributaries isolated.

Having acquired a clear idea of this picture with reservations for anomalies in the number and course of the vein, the surgeon is then ready to proceed with the execution of the operation.

The patient is made comfortable on the operating table with his heels placed as far apart as is convenient. In the case of obese individuals, a slight lowering of the cephalic end of the table may help to open up the inguinal fold.

The success we have had in decreasing the incidence of infection in amputation stumps by means of scrubbing the operative field with soap and water has prompted us to scrub the inguinal fold with soap and water for five minutes. The area is dried with a sterile towel and painted with merthiolate. The end of a damp towel folded longitudinally is pushed beneath the buttocks with a sponge holder, then the towel is laid over the vulva or made to envelop the male genitalia and dropped on the abdomen. An upper and a lower sheet are placed across the abdomen and thighs exposing both inguinal folds, then the area is covered with a laparotomy sheet. A towel is laid over the side to be done last.

There are two technics in common use today for exposing the long saphenous vein. Some men use a longitudinal incision over the terminal portion of the vein, while others prefer a transverse incision in the upper thigh. Dr. Friedrich Trendelenburg, after whom this operation is sometimes unjustifiably named, writes this much about the technic of the operation in his article on (Ligation of the Great Saphenous Vein in Varicose Veins of the Leg), "Generally the spot at the junction of the lower and middle third of the thigh, where as a rule a dilatation is especially marked, proves to be the most favorable point for finger compression and also for ligation. Several times I have done the ligation higher up, several times in addition to the main trunk, on the dilated accessory trunk or on the lesser saphenous which was also dilated and

communicating with the greater saphenous. . . . Scarcely anything needs to be said on the technique of the operation. The vein is exposed through a skin incision about three centimeters in length and isolated with the handle of the scalpel. Then the catgut suture is passed around above and below by means of an aneurysm needle, the leg raised in order to allow the blood to flow off, the vein doubly ligated and severed between the ligature, where-upon the skin incision is closed by suturing."

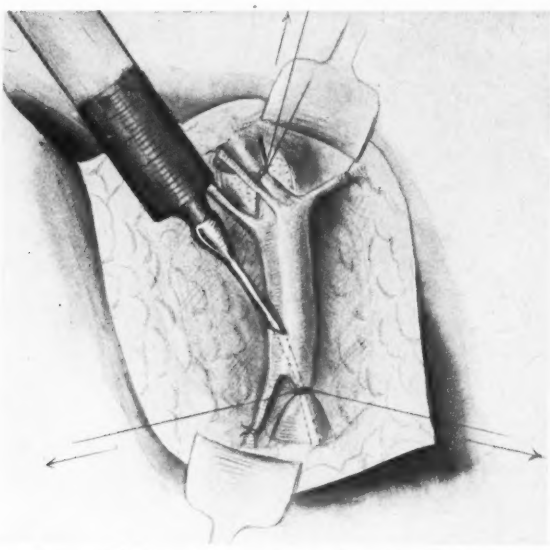

FIG. 3. Tributaries are ligated and vein is tied off distal to saphenous ampulla while sodium morrhuate is injected distally.

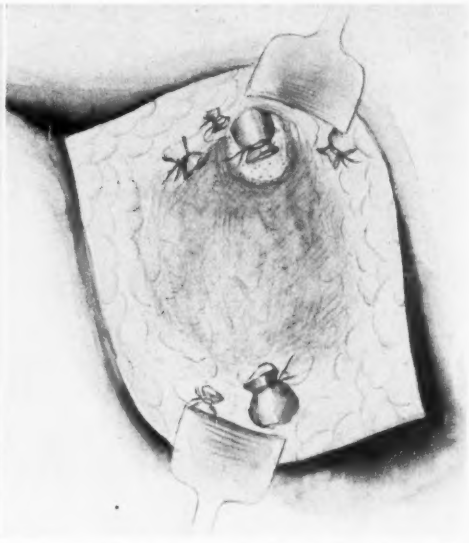

FIG. 4. Vein is resected after tying off distal end.

After years of observation and hundreds of ligations through several approaches, an incision into the medial third of the inguinal fold has proved most satisfactory for proper exposure of the saphenous vein at its junction with the femoral. This incision is superior to any other because it simplifies the technic and does away with tedious calculations that the occasional operator has to figure out before choosing the site of incision. In the big as well as the small individual, the fossa ovale is invariably exposed with this incision, and by making the incision high up in the thigh, the operator catches the vein before it had a chance to deviate either medially or laterally as would often happen when the incision is made lower down. Apart from the fact that the operation is greatly simplified by means of using this incision, the resulting scar gives the best cosmetic effect as it disappears into the inguinal fold while its greater length eventually becomes covered with hair.

For anesthesia, the unreliable field block and the often unsuccessful anterior crural and obturator nerve blocks are discarded in favor of the simple, never failing local infiltration. A wide longitudinal wheel is raised with ½ per cent novocaine over the medial third of the inguinal fold. Many a time this is all the anesthesia necessary for the entire procedure, although a supplemental infiltration of the areolar tissue down to the deep fascia is sometimes needed to complete the anesthesia. It is needless to emphasize the importance of guarding against intravenous injection of the anesthetic solution by traction upon the plunger while inserting the needle.

The incision is made into the crease of the inguinal fold. Once the skin is incised, two sharp retractors are introduced into the areolar tissue beneath the skin, the one nearest the left hand of the surgeon is held by the surgeon's left hand, the other by an assistant; and the retractors are pulled upward and apart. Traction is one of the greatest assets to the surgeon who knows how to make proper use of it.

For tissues under tension fall back when severed and retract out of the knife's way. By so doing, the chance of injuring structures unintentionally is minimized, and by pulling the severed edges apart, slicing of tissue is prevented, a factor which makes for better wound healing.

The incision is continued into the subcutaneous areolar tissue until the superficial fascia is exposed. The superficial fascia is then incised, and two small blunt retractors are used to separate the split fascia exposing the saphenous vein. If the vein exposed is not the long saphenous vein but only a tributary of it, tracing this tributary upward would invariably lead to the long saphenous. If no veins are visible upon retracting the severed edges of the superficial fascia, a curved blunt hemostat is inserted into the areolar tissue and this is opened longitudinally. The procedure is repeated until the vein is located. Once the vein is exposed, it is separated with the clamp from adjoining areolar tissue, then lifted from its bed with a plain thumb forceps while the curved clamp is passed behind it. The clamp is opened and a strand of No. 1 chromic catgut is fed into its jaw; then the clamp is closed and pulled out bringing with it the catgut strand. The two ends of the ligature are then held with the clamp and the ligature is used for traction. This maneuver, done so early in the procedure, before the vein is completely isolated from its surroundings comes in handy when, as sometimes happens while isolating the vein, a small tributary is torn and hemorrhage ensues. Traction on the ligature in such a case brings about instant hemostasis and saves the surgeon from having to work in a pool of blood or jabbing his hemostatic forceps blindly in an effort to stop the flood. After the ligature is passed around the vein, the vessel is followed upward and dissected by means of a plain thumb forceps from its anterior attachments, and with a curved hemostat from its enveloping bed. The tributaries are isolated until the saphenous ampulla is reached. The tributaries are tied off as far away from the vein as possible with No. 0 chromic catgut. A No. 1 chromic catgut ligature is passed around the vein and tied tightly just beyond the saphenous ampulla. The ends of this ligature are held with a hemostat for traction. A loose knot is made in the original traction ligature which is now held with the two hands of the assistant and pulled gently in order to prevent bleeding from the vein after it is opened by the surgeon. The surgeon, having a 5 cc. syringe filled with 5 per cent sodium morrhuate, and fitted with a Bellevue cannula, pulls up on the upper ligature with his left hand, while the assistant pulls upon the two strands of the lower ligature each with a hand. With a curved Mayo scissors, the surgeon nicks the edge of the vein between the two ligatures, then introduces the Bellevue cannula into the lumen of the incised vein and slides its tip into the untightened knot in the distal ligature held by the assistant. The assistant tightens the ligature over the cannula once the cannula's side eye is passed beyond the ligature. The surgeon injects his sclerosing solution and withdraws the cannula. The assistant tightens the knot and completes it. The lateral superficial femoral and sometimes the medial superficial femoral are tied off if exposed in the wound, but no special effort is made to isolate and ligate them. The tributaries are then cut off and the segment of vein between the two upper ligatures and the lower one is resected. Once the cut ends of the veins are inspected for bleeding, the sutures are cut and the severed ends of the vein allowed to retract into the wound while the tissues are permitted to fall together. Bleeders are then tied off and the skin is approximated with four or five clips. The wound is smeared with petrolatum jelly and covered with cellulose film. The wound is dressed with two gauze flats, and sealed tight with waterproof adhesive straps applied fanwise from the medial aspect of the thigh to cover the inguinal creases. The clips are removed on the fifth day, and after cleaning the area is dusted with talcum powder.

RELATIONSHIP OF SUTURE MATERIAL TO HEALING IN THORACOPLASTY WOUNDS*

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LANGSTON[1] has recently stressed the importance of the rôle of sensitivity to catgut in the healing of thoracoplasty wounds. His study of these wounds in this clinic revealed a striking difference in the healing of wounds closed with catgut and those closed with silk. However, his major premise was the allergic manifestations of catgut. Since his data were compiled, nonabsorbable suture material has been used in enough thoracoplasty operations to allow a large scale comparison of the two methods of closure. The purpose of this paper is to present a statistical study of the wound healing of 809 consecutive thoracoplasty stages performed on 195 patients from January, 1940, to January, 1942. The incisions were closed with catgut in 538 cases and with silk in 271 cases. Wound healing was studied not only in relation to the suture material used but also in relation to the method of suturing.[4]

One-half of the catgut wounds were closed with a continuous suture (which was occasionally interrupted), approximating the muscles in one layer with No. 0 or No. 00 chromic catgut. In most of the cases the subcutaneous fascia was approximated with interrupted No. 000 chromic catgut and the skin with interrupted silk. In the silk cases, each of the muscle layers was closed with interrupted No. 1 silk passed in small bites chiefly through the fascia; the subcutaneous fascia and skin were closed separately with interrupted No. 1 silk.

In the following study, all postoperative wound complications were distributed into three arbitrary groups:

GROUP A. Demonstrable fluid beneath the skin or muscles but without infection; slight skin separation with or without spontaneous escape of accumulated wound fluid, but without infection; indurated or red, "beefy" wounds which did not suppurate; small areas of skin necrosis in the suture line.

GROUP B. All subcutaneous wound infections with pyogenic organisms.

GROUP C. Submuscular or subscapular pyogenic wound infections; all tuberculous wound infections.

Of the 809 wounds studied, 121 showed complications of the above varieties, an incidence of 14.9 per cent. Not included are three wound complications obviously not related to the present study. Two of these were wound suppurations from empyema necessitatis, and one was a massive hemorrhage into the subscapular space following nine days of heparinization for a femoral embolus. Of the 538 thoracoplasty wounds closed with catgut, 102 developed wound difficulties, an incidence of 18.9 per cent. Nineteen or 7.0 per cent of the 271 wounds closed with silk had some complication.

Further analysis of the catgut wounds showed that different methods of closure had little influence upon the incidence of wound complications. Among 270 incisions closed with the continuous technic, fifty-three had complications, an incidence of 19.6 per cent. Of the 217 wounds in which an interrupted catgut closure was used, forty-four or 20.2 per cent had healing abnormalities. In fifty-one cases closed with catgut the surgeon failed to state

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the manner of closure. This group had five, or 9.8 per cent, cases of poor healing.

Table I gives a detailed analysis of the type of complications occurring with the two types of suture material and with the method of closure.

Table I

Suture Material	No. Stages	Group A		Group B		Group C	
		No.	Per Cent	No.	Per Cent	No.	Per Cent
Catgut Continuous.....	270	31	11.4	19	7.0	3	1.1
Catgut Interrupted.....	217	32	14.7	10	4.6	2	0.9
Catgut Unknown*	51	4	7.8	0	0	1	1.9
	538	67	12.4	29	5.3	6	1.1
Silk Interrupted.....	271	14	5.9	3	1.1	2	0.7

* Method of closure not stated by surgeon.

In the above table, Group A is worthy of special note. The great majority of cases placed in this group were those showing a red, edematous, "beefy" wound, usually with the formation of excessive wound fluid. The percentage of catgut wounds with this complication more than doubled the percentage of similar silk wounds. This is in accordance with the findings in this and other clinics which suggest that these complications may be due to catgut sensitivity. In none of these wounds did the inflammatory process proceed to frank suppuration.

Group A complications were never serious, and rarely delayed the subsequent operative stages. Groups B and C, therefore, comprise the complications which presented a threat to life or decreased the effectiveness of the thoracoplasty collapse by delaying further rib resection. Considering, therefore, the serious complications, it was found that 6.5 per cent of the catgut wounds fell into this classification, as contrasted with only 1.8 per cent of the silk technic wounds. Serious complications occurred three and one-half times more frequently in wounds closed with absorbable sutures. In none of the 195 patients who are the object of this study did the wound infection happen to be fatal.

Effect of Apicolysis. It has been stated that in the process of extrafascial separation of the pulmonary apex, numerous lymph channels are severed. By postulation, a higher incidence of deep wound infection should follow this procedure than follows a simple thoracoplasty. An apicolysis was done or attempted in forty-six of the 166 patients receiving a primary first-stage thoracoplasty. In none of the patients upon whom secondary or revision thoracoplasties were done was an apicolysis attempted. Eight of these forty-six patients developed postoperative wound complications, an incidence of 17.4 per cent. This percentage complication, however, appears of little significance since nineteen patients developed wound difficulties among the 151 patients receiving either primary or secondary first-stage thoracoplasties without apicolysis. This is an incidence of 12.5 per cent.

Table II
PRIMARY FIRST-STAGE THORACOPLASTIES WITH APICOLYSIS

Total Patients	Closure	Group A	Group B	Group C
46	Catgut	3	4	0
	Silk	1	0	0

In Table II it is notable that no deep submuscular or subscapular wound infections (Group C) appeared in this series of forty-six patients. In none of the forty-six patients, however, was an extensive apicolysis done. The extent of the extrafascial separation was never more than necessary to drop the apex to the level of the third rib posteriorly.

Effect of Formalin. The rubbing of the periosteum with 10 per cent formalin solution is the present method used in this hospital to prevent rapid stiffening of the thoracic wall by the formation of regenerated ribs between operative stages. Formalin was used on the exposed periosteal beds in 458 stages, or 56.6 per cent of the total number of operative stages. Seventy of these patients developed wound complications, an incidence of 15.2 per cent. The stages in which no formalin was used numbered 351; of these, fifty-four developed postoperative wound difficulties, an incidence of 15.3 per cent. The use of formalin cannot, therefore, be indicted in the production of wound complications.

Discussion. In reviewing the statistics of this series of 809 consecutive thoracoplasty stages, it must be remembered that the thoracoplasty wound has certain peculiar characteristics which have been pointed out by Langston. The great length of the parascapular incision, the anatomical necessity of leaving an extrapleural subscapular space which collects serum, and the reopening of the wound several times at approximately twenty-one-day intervals, all should tend to increase the incidence of healing complications. Apart from these mechanical factors, patients requiring thoracoplasty all have a certain general debilitation from their chronic tuberculosis. No attempt has been made to correlate the age, extent of disease and nutritional or vitamin balance of the patient with the postoperative wound complications that occurred. In spite of these mechanical and other factors, it is interesting to note that the percentage of infected wounds in this series, namely, 6.4 per cent with catgut closure and 1.8 per cent with silk closure, compares favorably with the percentages of infected wounds reported in other studies. Whipple[2] has compiled a seven-year study with 5.7 per cent infection with the use of catgut and 2.3 per cent with the use of silk in general surgical wounds. Brown[3] quotes Goff's figures of 10.0 per cent infection with catgut and 2.2 per cent with silk; Guthrie's figures of 2.9 per cent for catgut and 1.27 per cent for silk; and Longacre's figures of 15.4 per cent for catgut and 2.55 per cent for silk.

It may be added that since this study was carried out cotton has been used in our clinic with great satisfaction but there have as yet been too few wound closures with this suture material for statistical comparison of the complications.[5]

SUMMARY

The wounds of 809 consecutive thoracoplasty stages on 195 patients with pulmonary or pleural tuberculosis have been studied with relation to healing and the type of suture material used.

Minor or major complications occurred in 13.7 per cent of the wounds. The incidence was 18.9 per cent in the catgut wounds and 7.0 per cent in the silk wounds. By excluding all wound complications of a minor character and not specifically due to wound infection, the incidence was 6.5 per cent in the catgut series and 1.8 per cent in the silk series.

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FORESKIN ISOGRAFTS*

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IMPROVED treatment of burns and other conditions that destroy skin has resulted in a great saving of lives. The old maxim that the prognosis was hopeless if more than 50 per cent of the skin was destroyed no longer holds. There are occasional instances of the survival of patients with such large percentages of skin denuded that the patient's remaining skin is insufficient to cover the defect, in spite of improved methods of grafting. Recently, such a patient was under our care, and we were confronted with the necessity of obtaining skin from other sources. We turned to the use of foreskins, and believe that our results are worthy of recording.

There is no unanimity of opinion regarding the success of isoplastic skin grafting. Many surgeons have been unsuccessful with this procedure. MacWilliams,[1] Graham,[2] Holman[3] and others have stated that attempts to transplant isoplastic grafts are futile. Coller[4] states that such grafts are lost after several weeks. Greeley[5] thinks that grafts transferred from persons of the same blood group may take, but eventually are lost except in the cases of identical twins. Bettman[6] has used isografts as a temporary measure and thinks they are life saving, but he states that they melt away after four to five weeks. There is general agreement that zoo grafts are entirely unsuccessful.

Several workers have reported the successful use of isoplastic skin grafts. Davis[7] reported a large percentage of takes with such grafts. He stated that in several instances black pigmented skin was placed on white persons and the grafts became depigmented. Masson[8] reported success but thought that the bloods of donor and recipient must match. The only report of any number of foreskin grafts is that of Ashley.[9] He states that a fairly large percentage of the skin remained alive, and reports that McNealy experienced similar results. Ashley was able to keep the skin on ice for several days before using it. He does not report whether all the foreskins were taken from adults or infants.

Considerable attention has been given to the question of blood groups in isoplastic skin grafts. Ashley provided no data as to the blood groups. He believes it of no significance. Shawan,[10] Masson,[8] and Kubanyi[11] think that only skin from persons of the same blood group can be successfully grafted. Kubanyi also thought that tissues from embryos or infants could be grafted with greater success than tissues from adult animals.

Our first experience with isografts was on a patient who had second and third degree burns which completely denuded the skin from both arms, both legs and portions of the trunk. For weeks the patient had a stormy course with daily excursions of temperature to as high as 105°F. As soon as granulating surfaces about the elbow and knee joints were fairly clean, autogenous grafts were placed, using skin from the abdomen. These were only partially successful, and the reaction from even the short anesthesia was so severe that we were not anxious to repeat the procedure. Isoplastic grafting was then begun.

Preputial grafts were used for two reasons. They were easily obtainable because of the number of ritual circumcisions performed at the hospital, and also because the authors believed that the skin of infants has greater growth potentialities than that of adults. The technic employed was quite simple. The foreskins were collected under aseptic conditions at the time of circumci-

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sions. Careful examination, including serologic tests, and blood typing of the infant had been done. Later it was found that the stimulant to epithelialization from the border of the granulation area. Epithelium crowded in toward the transplanted skin

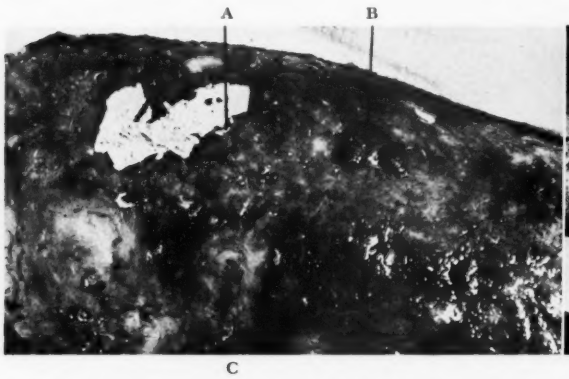

FIG. 1. Grafts of various ages in granulating surface of leg. A, twenty-four hour graft covered by silver foil. B, cyanotic graft forty-eight hours old. C, graft two weeks old with epithelium growing out from its edges.

FIG. 2. Showing leg with grafts of various ages on granulating surface. Note coalescence of grafts at A.

skins could be refrigerated in saline solution for as many as four to five days with equally good results. The mucosa was separated from the skin and the submucosal and subcuticular connective tissue was removed. The granulating wounds had been dressed with diluted Dakin's solution compresses (one-third strength). At the time of grafting the exuberant granulations were scraped off and the bleeding controlled by pressure for a short period of time. The small portions of skin or mucosa were placed over the prepared areas as pinch grafts, covered with silver foil, and the Dakin packs reapplied. The packs were kept moist with Dakin's solution and the whole area was wrapped in oiled silk. Dressings were changed daily. The silver foil prevented the grafts from coming off with the dressings. On a few occasions grafts were dislodged; they were reapplied and frequently became fixed.

The behavior of the transplanted skin differed little from autogenous pinch grafts. During the first thirty-six hours they became cyanotic. The cyanosis gradually faded and the skin became pink. (Fig. 1.) The mucosal grafts, by metaplasia of the epithelium, became cornified, resulting in formation of skin islands. The presence of the transplants of skin seemed to act as a islands. At the same time halos of epithelium arose around the skin grafts (Figs. 1 and 2) so that denuded areas were more rapidly covered. Dressings were changed daily, and pinch grafts were placed upon the areas as needed.

Skin was first transplanted about the knees and ankles to help cover the joints and permit motion. The rest of the legs and arms were then studded with islands of transplanted skin over a period of some weeks. As the denuded areas were covered the temperature came down toward normal. The final result was excellent.

In more recent cases changes in technic have been developed. These have simplified the procedure, done away with daily dressings, and have permitted skin grafting with foreskins on ambulatory patients. The bed of granulation tissue was prepared and the grafts placed as previously described. Sulfanilamide powder was sprinkled over the surface and the whole area covered with fine mesh petrolatum gauze. On small areas adhesive strips were used to hold the grafts in place before the vaseline gauze was applied. Sterile gauze was then placed over the vaseline gauze, then several layers of soft fluffed gauze or a sea sponge was applied for pressure. This technic did not require daily dressings and

usually the dressings were not disturbed for at least five days. When the vaseline gauze was removed there was moderate amount of secretion, sometimes purulent. Despite the exudate the grafts were found to be adherent to the granulating surface in a higher percentage of instances than with the moist Dakin's pack method. As the dressings need not be moist or changed daily this treatment can be used on the outpatient who returns about every five days for changing of dressings and additional grafts. In either method the actual application of the grafts is painless since granulation tissue has practically no sensation.

Cadaver skin has been used in a similar manner as isografts. The donor skin was obtained from premature infants in whom the only cause of death was prematurity. An autopsy is performed on a very large percentage of the premature infants who die at this hospital. Before the postmortem examination was done, split skin donor grafts were removed with a razor, under aseptic precaution, within the first half hour after death. The skin was placed in sterile normal saline solution and kept in the refrigerator until the autopsy had demonstrated the cause of death. If there were no contraindications to use of the skin, it was cut into small sections about 1 cm. square and used just as the foreskins grafts. In these cases the sulfanilamide with vaseline gauze technic was used.

The results in our series of cases were most gratifying. We used about sixty foreskins, about five hundred pieces of skin and mucosa. Well over 65 per cent of the earlier group of grafts became attached and lived. About 75 per cent of the more recent grafts took. It seemed that less frequent dressings and pressure definitely increased the percentage of good results. The success of the transplants is as dependent upon cleanliness and vascularity of the recipient site as are autogenous grafts. The authors attempted transplants on relatively unclean granulation tissue and only 40 to 50 per cent of the grafts were successful. If only one-half of the homogeneous grafts are successful, one has still aided in covering the denuded areas. The procedure can be readily repeated to compensate for the smaller number of takes. The patient does not have to be subjected to an operative procedure or anesthesia which would hardly be worth while if the recipient sites were covered with slough. Valuable time in rehabilitating the patient is thus saved.

Fig. 3. Isoplastic grafts on thigh showing coalescence and epithelialization about the grafts.

Isoplastic grafts were also used to heal skin defects from other causes, as in varicose and trophic ulcer in which the floor of the ulcer was made up of fairly healthy granulation tissue, but the skin edges lacked the ability to cover over the defect. The presence of the island of skin seemed to act as a stimulus to the skin at the margin of the ulcer. The skin edges showed new activity and epithelium crowded in toward the grafted island.

In some cases the transplanted skin did not take, but its presence seemed to act definitely as a stimulant to the ulcer margin, greatly speeding healing. In varicose ulcers the grafts can be applied using the sulfanilamide powder method outlined and then an Unna's paste boot applied.

Another patient treated by this method had a defect following a radical mastectomy. The extent of the pathology required

such a radical removal of mammary tissue and skin that an immediate autogenous graft was done. This graft did not take

Fig. 4. Grafts on the breast near areola. These are eight months old. The area below the nipple is where a graft absorbed after about ten weeks. The surrounding tissue is thin, vascular scar epithelium.

and the patient was left with a granulating defect. Foreskin grafts were used to cover the area and most of these skin grafts were placed on her after she was dismissed from the hospital.

Another patient treated as an outpatient was a boy two and a half years of age who suffered burns of both thighs involving his knees. The knees were covered with autogenous skin while he was a patient in the hospital. This enabled him to be up and walking. The thighs were then studded with islands of transplanted skin on his bi-weekly visits to the hospital. (Fig. 3.) During the weeks necessary for complete epithelialization he was able to be at home and even rode his tricycle.

In another case foreskin grafts were used to cover granulation tissue following an extensive loss of integument as a result of osteomyelitis with multiple draining sinuses. This patient had a loss of skin over both forearms and both thighs. His course was septic when the grafts were started. Such a patient, in view of the fact that the skin had sloughed off due to infection, is not a good subject for skin grafts. However, the foreskin transplants took surprisingly well, and aided greatly in covering the granulation tissue.

SUMMARY OF FINDINGS

The authors believe that the use of skin from the newborn and premature infants is an important factor in the success of isoplastic skin transplants. The nucleii of the cells of the skin of these infants contain a higher percentage of mitotic figures than do those of the skin of adults, suggesting that growth potentialities are greater. In our experience the blood groups of the donor did not influence the survival of the grafts. It was our experience that the blood grouping of about 25 per cent of the infant donors cannot be accurately determined.

The survival of transplanted skin in this series of cases varied between 65 and 75 per cent. Even in the cases in which the transplants failed to survive the presence of the skin seemed to act as a stimulant to the patient's own epithelium and more rapid epithelialization was a result.

We know of no method of determining the length of survival of transplanted skin, but in our experience this skin, once having taken, did not melt away in several weeks as Bettman,[6] Greeley,[5] Coller[4] and others described. Some grafts could be distinctly recognized eight months later. (Fig. 4.) It is impossible for us to say how long these survive, or if they are ultimately replaced. One of the cases followed over a period of two years had no loss of grafted skin with the exception of two tiny areas. (Fig. 4.) The others which were followed for shorter periods had practically no loss of skin. Several occurrences in the course of the work have given added weight to the observation that the grafts remain longer than other reports indicate. In one case a graft had not been placed on firmly and in

healing a small papilla-like crease of skin protruded. This remained without changing and finally was removed three and a half months after the graft had been applied. In one instance of transplantation of skin from a premature cadaver the lanugo hairs persisted for many weeks. In a colored patient a very small piece of white skin was transplanted to an inconspicuous area. This white skin became attached and remained.

We are emphatically not advocating this type of graft to replace other methods now in use, for obvious reasons. The end results from the cosmetic viewpoint are definitely not as good as with split thickness autogenous grafts. However, we do believe that in certain instances it is of great value as a life saving measure. The range of its use is increased by the fact that it may be used on the ambulant patient, and on surfaces that are not entirely surgically clean. The production of another open wound at the donor site, and the use of anesthesia are obviated by this method.

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SACROCOCCYGEAL CYSTS

REPORT OF 200 CASES IN AN ARMY HOSPITAL

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THE officers connected with the Surgical Service of this Station Hospital, were greatly interested in the report rendered by Lt. Col. William J. Pickett, M.C., and 1st Lt. Arch J. Beatty, M.C., which appeared in the May, 1942, issue of the *American Journal of Surgery*. This article dealt with thirty cases of pilonidal cysts treated at Fort Sill, Oklahoma, Station Hospital, over a period of approximately three months during the latter part of 1941. It encouraged us to accumulate data on similar cases and to present it here as additional information on this relatively frequent and unusually stubborn malady.

No attempt will be made to enter into a discussion of the cause and progress of the condition, but these remarks will be confined to a more or less statistical report of our cases, contrasting our methods of treatment and recording our conclusions.

From November 1940, when this Station Hospital began to function, until August 20, 1942, we have seen and operated upon 200 patients with conditions varying from small non-infected sacrococcygeal dimples to severe, extensive, and ramifying sinuses. This figure does not represent the total number of sacrococcygeal cysts that have come under our observation. In the period before December 7, 1941, a few patients were discharged from active military service because of this physical disability, and at least twenty-five to thirty patients were treated conservatively and returned to duty in good condition without major surgery.

The percentage of incidence is essentially the same here as at Fort Sill; that is, approximately 0.1 per cent, with the majority of races represented. There has been only one case in the Negro race, this probably being due to our small Negro population at Fort Jackson.

Our cases of sacrococcygeal cysts can be classified under two periods according to the type of operative procedure used: (1) the open method of repair and (2) the closed method of repair. In the first period from the opening of the hospital until March 1, 1942, 123 patients were operated upon, of which approximately 90 per cent of the wounds were left open and packed lightly with iodoform gauze. Sulfanilamide powder was placed in the operative wound of about 40 per cent of the cases with, what we consider, some benefit. During the second period, from March 1st until the present time, seventy-seven patients have been operated upon, of which sixty-three wounds were closed completely, ten partially closed, and four left open and packed with iodoform gauze. Of the sixty-three wounds closed completely, thirty-two, or approximately 50 per cent, healed primarily; that is 42 per cent of the total of seventy-seven patients operated upon in the second period. Of the remaining thirty-one cases, there was more than 50 per cent primary healing in twenty-six cases; in only five did the wound break down completely.

Our method of closure is neither new nor original. Complete hemostasis was obtained and the dead space obliterated by two layers of interrupted sutures of No. 1 chromic catgut, and closure completed by interrupted, deep, transverse, mattress sutures of silk or silkworm gut. We believe that this last suture is important because it prevents inversion of skin which is a frequent cause of failure of the wound to heal primarily. Recently, we have used

silkworm gut exclusively in closing the skin as there seems to be considerably less tissue reaction than when silk or catgut is used.

Fig. 1. Five weeks after original operation and just prior to application of split skin graft to upper limb of wound.

Sulfanilamide was used locally in only six of the wounds that were closed, and in most of these cases there seemed to be rather marked tissue reaction which interfered with healing, but we are of the opinion that most of this was probably due to an excessive amount of the drug being used.

Our preoperative treatment did not differ essentially from that used at Fort Sill, the important thing being to get the infection and the drainage from the pilonidal sinuses cleared up as much as possible prior to operation. Closure was attempted without regard to the severity of infection, the criterion being mainly whether dead space could be obliterated and the wound approximated without too much tension.

Postoperative treatment was as follows: The patient was kept flat for eight hours following spinal anesthesia; liquids were given the day of operation and the day following; a soft diet was given on the second postoperative day and regular diet on the fifth postoperative day; morphine, gr. ¼, was given when necessary for the first twenty-four hours, and codeine and aspirin by mouth were sufficient in most cases after the first twenty-four hours. Sutures were removed on the fifth postoperative day. Hot Sitz baths were started on the fifth postoperative day after sutures were removed.

Fig. 2. Two weeks following application of skin graft, donor wound healed, grafted area completely covered.

The wound was dressed daily, beginning on the second postoperative day and sutures removed earlier than the fifth postoperative day if infection had developed. In such instances the wound was opened sufficiently to supply adequate drainage and packed with iodoform gauze for from twenty-four to forty-eight hours. The wound was then irrigated with azochloramide-in-triacetin, 1–5000, and some azochloramide was left in the wound. It has been found that after treating the wound with this solution for four or five days, a small amount of sulfanilamide placed in the wound once daily seemed to help considerably in reducing infection and in stimulating granulation. The wound was then allowed to granulate as if it had been left open originally, and in almost every case seemed to heal faster than it would have if it had been left open at the time of

operation, due to the fact that there was usually some healing from each end which had a tendency to pull the wound partially

FIG. 3. Three weeks following skin graft, wound healed, patient ready for discharge.

together and leave a smaller area for granulation.

The average number of hospital days required in the open method of treatment was fifty-two; the shortest twenty-seven, the longest 136. In our closed method of treatment, the average number of hospital days was thirty-three; the shortest twelve, and the longest seventy-six. Almost all of the patients with primary healing were kept in the hospital at least eighteen to twenty-one days to insure sufficient healing and prevent breaking down of the wound after the soldier had returned to duty.

As to recurrences, we have had twelve patients who were operated upon by the open method and readmitted with return of symptoms. Six of these, or 50 per cent, have required reoperation, at which time the wound was closed tightly. The other six, all of which healed satisfactorily, were treated conservatively with hot packs, hot Sitz baths, azochloramide packs, and sulfanilamide powder. Of the patients who were treated by the closed method, only three have been readmitted. Only one of these required reoperation, the others only had mild fissuring of the scar which healed in a few days under hot Sitz baths, azochloramide dressings and local application of sulfanilamide powder.

In only one case did the sinus tract extend into the sacral canal. In three cases, the sinus extended markedly caudal and anterior to the coccyx. The one entering the sacral canal recurred, and this possibly could have been prevented if the coccyx had been removed at operation.

General anesthesia—nitrous oxide and ether—was used in two instances due to personal preference of the patient. Spinal anesthesia—100 mg. of procaine crystals—was used in all other cases. This amount of anesthesia was sufficient in every case except two, in which the spinal anesthesia did not seem to take effect, and it was then supplemented with nitrous oxide-ether anesthesia.

We think it is worthy of note that in the ten wounds closed partially, the proximal and distal portions of the wound being closed and the central area packed with iodoform gauze, the closed areas healed primarily in practically every instance and the central part granulated in rapidly, reducing the number of days of hospitalization materially. It is believed that this is better than putting an excessive amount of tension on the sutures trying to close the wound completely as these wounds become infected and break down in practically every instance.

We realize fully that sufficient time has not elapsed since the beginning of our closed method of treatment for fair comparison with the open method, but our results thus far with the closed method have been so gratifying that we think it amply justifies our enthusiasm.

SUMMARY

We presented the results of 200 cases of pilonidal cysts seen and operated upon

among Army personnel, chiefly new recruits, over a period of twenty-one months. The high incidence and the etiological factor of trauma as previously reported is substantiated. Spinal anesthesia again proves to be the anesthetic of choice. Primary closure was found to be definitely superior to the open method of treatment, both in the results obtained and in the markedly decreased number of hospital days.

ADDENDUM

Since submitting the above paper for publication, we have operated upon 120 additional patients with pilonidal cyst. One hundred of these 120 patients have been operated upon for at least a four-week period and we believe that they should be included in our report. Of the total one hundred cases, ninety wounds were closed tightly and ten were partially closed. Of the ninety that were closed, forty-seven healed primarily and were considered cured; forty broke down partially and required further treatment; three broke down completely and were allowed to granulate from the bottom.

The local application of sulfanilamide powder was used only in those wounds that were definitely infected and draining prior to operation, and this procedure apparently reacted beneficially in helping to obtain primary union.

The postoperative care has been changed somewhat in the group of wounds that did not heal primarily. The two main changes were heliotherapy and skin grafting. The buttock was held apart by means of adhesive strapping as in the original operative procedure, and sun light or artificial ultraviolet light applied directly to the wound. This was used progressively and in graduated doses and definitely shortened the period of healing. We have found that split skin grafts will take on healthy granulations in this area, and this also materially shortens the healing period.

We have had ten patients readmitted to the hospital after discharge to duty, usually from seven to twenty-one days following full duty status. Two of these patients were operated during the open method period. All cases presented from one to three draining sinuses in the middle or lower third of the excisional scar. Upon probing, it was found that the sinuses were moderately superficial and not very extensive. In each instance incision was made opening the sinus from 1 to 1½ inches in length and ½ to 1 inch in depth. The wounds were packed with iodoform gauze for twenty-four hours, after which they were left open and treated as other infected postoperative pilonidal wounds. Rapid granulation and healing occurred in every case, and healing was usually complete within fourteen to twenty-one days without further trouble, proving that the majority of patients readmitted to the hospital with recurrences do not have true recurrences but probably a small pocket beneath the skin filled with serum which aggravation by active duty and rough treatment caused to distend further and break through the skin surfaces.

We submit the following case history with illustrations:

Sgt. W. J. S. gave a history of multiple draining sinuses of the sacrococcygeal region of several years' duration. The involved area extended from the uppermost part of the sacrum down to and involving the perianal region. There were several openings into the right buttock. The entire area was excised; the incision extended to the right and well beyond the anus. We were able to close the entire tract primarily except for the upper limb which extended approximately 10 cm. to the left of the midline. This was allowed to granulate for five weeks and then a large split graft, obtained from the lumbar region, was applied. He was returned to full duty sixty days following the initial operation.

PILONIDAL CYST*

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THIS paper is presented to supplement the report of a new operation and treatment for pilonidal cyst.[1] We have had the opportunity of operating upon thirty additional patients in the two and one-half-month period from April 1st until June 15, 1942. We wish to advocate further that anatomical dissection should replace block excision. We have had occasion to alter the incision and dissection in cases in which the arrangement of the sinus openings demanded it. Minor alterations in the technic are presented. The healing time has been reduced to one-half of that previously reported.[1] The economic implications in reduced healing time for both the Army and civilian practice are obvious.

Anatomical Dissection. Because the incidence of pilonidal cyst is high at this Post, we have had almost daily contact with the condition at the operating table. Inquiry has revealed that the incidence is high elsewhere in the Army. A report[2] by Pickett and Beatty from Fort Sill, Oklahoma, in which thirty patients were operated upon in ninety-seven days is confirmatory.

Frequent contact with pilonidal cyst, in a brief period of time, has permitted observation not only of the numerous variations which the cysts and sinus arrangements may assume, but a particular phase of technic started, could, in a similar case, be improved upon while it is still fresh in mind. Likewise, it is this frequent contact with the operation which has done most to dispel the idea that a mystery enshrouds the ramifications of the sinus tracts and the sacculations. It has been a maxim handed down through medical school and from surgeon to surgeon, that in order to excise a pilonidal cyst completely, one must remove "en bloc," the skin, cyst and a wide area of surrounding tissue. Because tracts and cyst walls ramify laterally and downward toward the anus this type of excision will fail in upwards of 25 per cent of the cases. One has not only sacrificed a greal deal of normal tissue but has left sac wall for recurrences.

On the other hand, by leaving an island of skin about the sinus openings and tracing the underlying structures with the aid of methylene blue stain and a probe for guidance, the problem of dissection is no more complicated than for fistulas or sinus tracts elsewhere in the body. It is true that fibrous cords which are not patent and cannot be probed may extend from the sac. Occasionally, a fibrous cord ¼ inch in diameter extends upward directly under the skin in the midline for 1 to 2 inches. That these cords cannot be probed or do not stain is of no significance, since they are perfectly recognizable in dissection and one may remove them with the sac *in toto.*

We broadly inferred in the first report[1] that we believed the chances for complete removal were infinitely increased by anatomical dissection. Almost daily experience with dissection of complete sinus tracts and cysts has confirmed this opinion, and it has become quite obvious to us that the rationale for block excision has no "raison d'etre."

Additional Types of Incisions and Dissections. We believe that the variations which the sinus openings assume, the incision and dissection employed for each, may best be presented by diagrammatic drawings. (Figs. 1 to 5.)

One of us (C. L.) has advocated the use of a rectangular flap instead of the U-shaped flap originally described.[1] (Fig. 4.) In some instances this is more advantageous in

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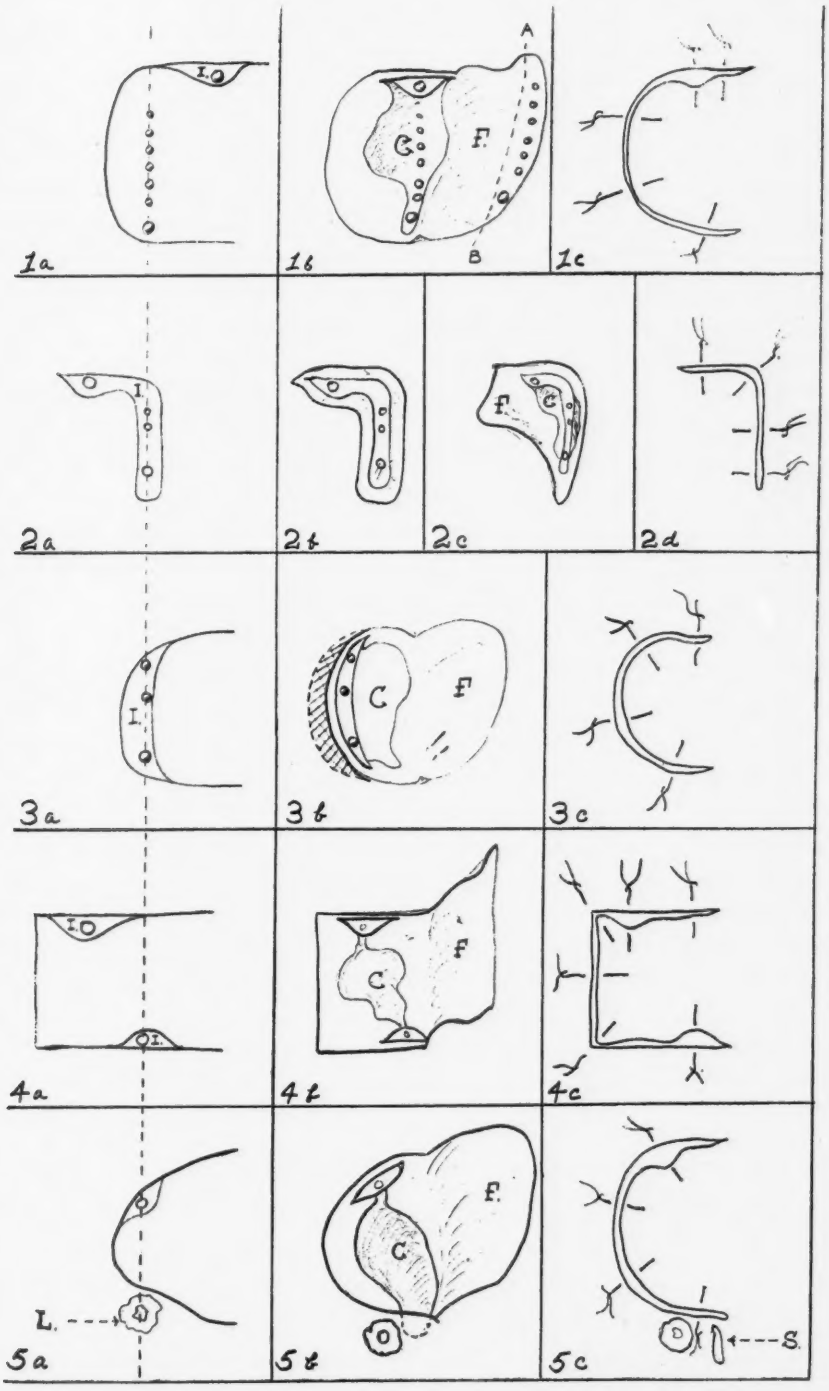

FIGS. 1 TO 5. In Figures 1, 3, 4 and 5, *a* represents the incision, *b* the reflection of the flap with exposure of the sac, *c* the refitting of the flap with suture. Figure 2*b* represents undercutting of the skin edges about the skin island. The interrupted line running through *a* Figures 1 to 5 represents the midline; the heavy black line is the incision. I is the skin island left around the sinus openings which are depicted as small circles. C is the exposed cyst. F the reflected flap. Figure 1*b*, the interrupted line A to B represents excision of skin and sinus openings trimmed off flap. Figure 3*b* cross hatching outlines additional skin removed so the flap will fit better after dead space is obliterated. Figure 5, L is the anus, S is the stab wound described in the text.

that the subsequent refitting of the flap into the defect is more easily accomplished.

Refinements in Technic. There have been a few minor refinements in technic and care, but these have materially aided in reducing the healing time still further.

Further experience with the operation has enabled us to become more ingenious, and we were able to effect complete closure in all cases of this series. Separation at the lower angle following removal of sutures still occurs. Now, however, we do not continue to reapply sulfathiazole, cod-liver oil, lanolin dressings for more than two or three days, because we found that the skin edges were kept too soft. After the period of ointment dressings, we paint the whole wound and lower angle either with tincture of merthiolate or 10 per cent mercurochrome. These dry the skin edges and permit the serum to crust. Epithelization occurs underneath.

We have also learned to approximate the skin edges loosely near the lower angle, to permit the ointment placed in the depths of the wound to leak out. Pressure exerted by having the patient lie on his back is a further aid in this direction. The approximation of skin edges is better if all the silkworm Stewart sutures are tied on the skin edge opposite the flap. (Figs. 1 to 5.)

Results. The average healing time in this series of thirty cases is 13.3 days. This is approximately one-half the average healing time reported for the original series of thirty cases,[1] and must be compared to the healing time following block excision which may be from eight weeks to upward of six months. The healing time ranged in days from six to twenty-six. We do not believe that the healing time can be reduced below this level. Because healing was so rapid, to insure good results we recommended a two weeks furlough for all patients before they returned to duty. We attribute the marked improvement in healing time to our ability to effect complete closure in all cases.

We have now had five cases in which large sacculations extended downward and were subjacent to the skin lateral to the anus. These were completely closed but a small stab wound was placed lateral to the anus through which the ointment could drain. These have all healed per primum.

We have now been able to follow up about 50 per cent of the original series of thirty cases for three to five months and a similar number of the first cases in this series for one and one-half to two months. Except for one case, all the patients followed, are solidly healed. The scar fades and becomes barely perceptible. There has been no complaint of pain, no abscess formation nor recurrence. The one case excepted presented himself for hospitalization three weeks following discharge; the lower angle was open and there was a midline tunnel under the flap from the lower angle extending to the upper limit of the healed flap. Although the wound was completely healed on discharge it was not solid enough to withstand sliding into home plate during a baseball game two weeks later. Daily insertion of the ointment into the tunnel brought about granulation closure in one week.

In those cases in which the cyst wall was dissected away from the anal sphincters and anal wall, there has been no change in bowel habits.

SUMMARY

1. A supplementary report of thirty additional cases of pilonidal cyst operated and treated by a new method, is presented.

2. Anatomical dissection is advocated; block excision is deprecated.

3. Diagrammatic sketches are presented to show various sinus arrangements and the incision and dissection employed for each.

4. Minor variations in technic are described.

5. The average healing time for thirty cases is 13.3 days. Follow-up indicates very good results.

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DEMEROL HYDROCHLORIDE

A NEW DRUG IN THE PRACTICE OF SURGERY

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AMERICAN literature reveals only a brief amount of clinical information concerning this new drug. Eisleb and Schaumann[1] discovered Demerol in 1939 in the course of a search for compounds having spasmolytic properties of the atropine series of drugs. It was introduced in Europe as Dolantin, Dolantol, D-140. The chemical structure is 1-methyl-4-phenylpiperidine-4-carbonic acid ethylester, with the following formula (Fig. 1):

Demerol is a white crystalline substance slightly soluble in water and with a strong alkaline reaction. The hydrochloride is employed medicinally as it is readily soluble in water and has a neutral reaction, with a slightly bitter taste. The solution is not decomposed by a short boiling period.

Demerol hydrochloride has a distinct relaxing action on the smooth muscles of the bowel, the uterus, the bronchial tree and the urinary bladder. This action is said to be due in part to depression of the parasympathetic endings, but primarily is the result of a direct depressive effect on the muscles themselves resembling the effect of papaverine.

In experimental work with animals, it was found that toxic doses of Demerol Hydrochloride produced excitement, salivation, and ataxia; and that extreme doses caused ataxia associated with spasticity and chronic convulsions. Prolonged use of the drug was found not to affect the hematopoietic system in dogs. Continued use of the drug may cause habituation but not addiction.

Demerol Hydrochloride is broken down very rapidly after oral or parenteral administration to the intact animal. The rapidity of the breakdown makes it very difficult to trace the components of the drug. Only in extremely toxic doses is presence of the drug demonstrated in the urine. It is thought to be broken down by the liver and to a much lesser extent by tissues of the central nervous system.

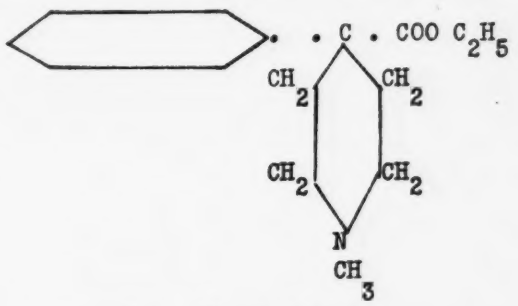

FIG. 1. Chemical formula.

Demerol Hydrochloride is nonhemolytic, is a depressant to smooth muscle tissue, and has an antagonistic action to acetylcholine on the heart and intestines as well as an antagonistic action to histamine on the intestines. It is an effective antispasmodic, relatively nontoxic and nonnarcotic in action.

In therapy, Demerol Hydrochloride possesses three main properties: analgesic, antispasmodic and sedative. The analgesic action is comparable to that of morphine. Its antispasmodic action is comparable to and even superior to that of the opiates. The sedative effect is definite, sleep is produced but not as deeply as with morphine. Therapeutic doses produce a slightly sedative and marked analgesic action. Large doses temporarily reduce the blood pressure with slowing of respiration, although ordinary doses affect neither the blood pressure nor the respiration.

In animals, there is no evidence of physical dependence following repeated doses

of the drug, nor does toleration or accumulation occur in them. In men, the analgesic effect appears to be between that of morphine and codeine and persists from three to six hours. Occasionally, the drug will produce a euphoria which lasts only a short time.

Duguid and Heathcote,[2] in 1940, repeated the experiments and confirmed the findings of Eisleb and Schaumann[1] on Demerol. In 1941, Gruber, Hart, and Gruber[3] made a complete review of the work of Eisleb and Schaumann and reported confirmation of their studies on Demerol. In 1942, Barlow[4] made a careful study of this drug and corroborated the findings previously reported.

My experience in the use of Demerol Hydrochloride has been gained in the cases as shown in the opposite column.

The only untoward effects noted in these cases were occasional slight nausea, slight dizziness, flushing of face, sweating, and dryness of mouth, and also slight feeling of weakness or syncope. These effects were of brief duration and as a rule did not cause any inconvenience to the patients.

Demerol Hydrochloride was used in all the above cases with satisfying results without resorting to the use of morphine. Almost without exception, patients were relieved of their pain and sufficient rest was obtained to warrant further use of the drug.

My observations in these cases showed the following comparison between the results of Demerol Hydrochloride and morphine:

	Demerol Hydrochloride	Morphine
1. Nausea and vomiting	Slight	Fairly common
2. As a preoperative drug.	Synergistic to anesthesia. Only slight depression of respiration, blood pressure, and pulse	Depressing to respiration, blood pressure, and pulse
3. Constipation	None	Common
4. Action	Combined action of morphine and atropine	Atropine usually added
5. Analgesia	Equal to that of morphine, but with less depression	
6. As a postoperative drug.	May be used frequently with little danger of addiction or habituation	Caution must be used against both addiction and habituation

Surgical Procedures	Number
Exploration of common duct	2
Cholecystectomy	12
Appendectomy	42
Ventral suspension with appendectomy	1
Excision of large simple ovarian cyst with appendectomy	2
Thyroidectomy	5
Subtotal hysterectomy	8
Total hysterectomy	8
Cesarean section	1
Femoral herniotomy	1
Inguinal herniotomy	2
Ventral herniotomy	1
Resection of sigmoid	1
Second stage Mikulicz	1
Colostomy closure	1
Coagulation of tumor of rectum	1
Nephrectomy	1
Excision and plastic for radiation burn over sacrum	1
Excision of metastasis of glands in neck	1
Adnexal operations on tubes and ovaries and round ligaments	8
Radical mastectomy	3
Talma-Morison operation	1
Suprapubic prostatectomy	1
Suprapubic cystotomy for carcinoma of bladder, with radium insertion	1
Genitourinary procedures consisting of cystoscopic pyelograms and bladder fulgurations	14
Meckel's diverticulum	2
Transurethral resection of bladder carcinoma	1
Dilatation and curettage for biopsy	6
Hemorrhoidectomy and excision of rectal fissure	12
Excision of Bartholin's glands	2
Drainage of axillary abscess	1
Excision of pilonidal cyst	1
Incision and drainage of arm	1
Suture of palmar surface of hand	1
Excision of cyst from forehead	1
Excision of cyst of neck	1
Excision of tumor of neck	1
Excision of foreign body from cheek	1
Excision of tumor of left wrist	1
Excision of lipoma of hip	1
Incision of perirectal abscess	1
Biopsy of tumor of rectum, with radon insertion	1
Removal of tonsils and adenoids	11
Fracture of spine—cast	1
Fracture of humerus—reduction and cast	1
Colles' fracture—reduction and cast	1
Bilateral saphenous vein ligation	8
Salpingectomy for tubal pregnancy	4
Stomach resection	1
	182
Additional Cases Treated	
Primary carcinoma of lung, inoperable	2
Metastasis following carcinoma of breast amputation, inoperable	2
Thrombophlebitis of femoral vein	3
	7
Total cases	189

We have found Demerol Hydrochloride ideal as a preanesthetic medication. It is particularly valuable in surgery of the mouth and throat in which analgesia and control of the salivary flow are desired, and also as a routine preoperative sedative to replace the use of morphine and atropine frequently employed by many surgeons. Batterman and Rovenstine[5] recently reported on the utility of Demerol as a substitute for the opiates in preanesthetic medication. Also, Batterman and Mulholland[6] have recently reported on the use of Demerol as a substitute for morphine in the treatment of postoperative pain.

My experience with the use of Demerol Hydrochloride preoperatively and postoperatively has proved that 100 mg. is sufficient for the ordinary adult, and in many cases 50 mg., or half an ampule, is ample. This dose usually is effective within fifteen minutes by hypo. The drug may also be given orally in 50 mg. tablets, with two tablets to the dose, producing analgesia within twenty to sixty minutes. However, I have found the parenteral route definitely more satisfactory.

The dosage should vary according to the age, weight, and general condition of the patient, in the same manner as for morphine, i.e., for a senile patient 50 mg. should suffice but this may be repeated pro re nata; and for children, 10 to 50 mg. per hypo or double this dose in tablet form, dosage ranging according to age and weight.

Sprockhoff[7] in a recent article attests to the safety of Demerol Hydrochloride for children, reporting his vast experience in use of the drug, with good results, in croup and whooping cough.

Batterman[8] in recent studies on this new drug, emphasizes the effectiveness and safety thereof for relief of pain in medical and surgical conditions.

SUMMARY

1. Demerol Hydrochloride is a safe analgesic and antispasmodic drug.

2. In ordinary dosage, it is not depressing to the respiratory or circulatory systems.

3. It does not damage the hematopoietic system.

4. It may be used preoperatively with safety as a synergist with all types of anesthesia.

5. It may be used postoperatively to replace morphine in almost all cases.

6. Demerol Hydrochloride has all the advantages of morphine but few of its disadvantages.

7. The use of Demerol Hydrochloride in surgical practice is recommended for the alleviation of pain.

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LOBELIN IN ASPHYXIA DURING GUNSHOT SURGERY*

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WITH the increasing participation of the United States in the war, penetrating wounds are of particular concern to the surgeon. The wounds received in military combat are more severe than those encountered in civilian life, nevertheless, there are no essential differences in the nature of these wounds. The causes of death are the same in each instance, either hemorrhage or shock, while if these are survived, peritonitis, as in the case of abdominal wounds, may be the factor in the ultimate death of the patient. That military mortality, as a result of gunshot wounds, is considerably higher than in civilian life is easily understood in that military casualties in most cases cannot be given the immediate surgical care and attention which is possible in the case of civilian injuries.

Asphyxia is a frequent problem in the surgical repair of gunshot wounds. This is especially true during the exploratory operations necessary in the case of abdominal wounds. Asphyxia may result because of shock or because of failure of the respiratory center during anesthesia. Postoperative asphyxia because of overdoses of morphine, veronal and other drugs must also be considered.

There are several methods employed in the treatment of these conditions. Artificial respiration, while valuable, is often impractical. The administration of atropine, caffeine or strychnine may be tried, yet there are limitations to this treatment and contraindications which may preclude its use.

After watching the results obtained, in many hospitals, in cases of asphyxia neonatorum by the use of Lobelin, we made use of this product in our early experiments and finally selected this drug for a long range test in the treatment of asphyxia during gunshot surgery.

One hundred seventeen cases of asphyxia due to shock came to our attention during these experiments. All were police cases, brought to our institution following gang wars, fights and robberies. All were abdominal wounds, having multiple gut perforations and most of the patients were in complete shock upon their arrival in surgery, more than one hour after the injury.

In ninety-six of these cases, Lobelin was administered as soon as respiratory failure was observed and in all ninety-six cases this condition was successfully overcome. One cc. of Lobelin was injected intravenously and in a few seconds, cyanosis had disappeared, respiration became normal and surgical procedures could be resumed. In the remaining twenty-one cases other methods were used and the high percentage of mortality which occurred convinced us that only Lobelin answered our need for a quick-acting, satisfactory respiratory stimulant. Lobelin, when injected intravenously reacted favorably within eleven seconds, regardless of the dose and the effects lasted for twenty minutes. In no cases was a second injection necessary. Intramuscular and subcutaneous injections of Lobelin were also tried but since the reactions produced by these methods were slow and doubtful, these procedures were abandoned in favor of the highly satisfactory intravenous injection. (Table 1.)

Lobelin is obtained from the herb Lobelia inflata, a member of the nicotine

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† At the present time A. J. Toman, M.D., is in the Medical Corps of the U.S. Naval Reserve. The material submitted in this article has no connection with cases in the U.S. Navy.

group. However, unlike the other members of this group, Lobelin does not demonstrate the toxicity or other ill effects attributed to the nicotines. Recognized in 1813 by Cutler, it was first isolated only in the form of impure, amorphous salts. In 1916, Wieland[1] succeeded in preparing a pure, crystalline hydrochloride salt from the plant which is known chemically as Alpha-Lobelin Hydrochloride with the empirical formula $C_{22}H_{27}O_2N$ HCl.

Table 1

No. Cases Treated	Cases in Which Lobelin Was Administered	Cases in Which Other Methods Were Employed	Recovered after Lobelin Administration	Recovered after Other Methods
117	96	21	96	0

Solis-Cohen and Githens[2] state that pure Lobelin has a stimulating effect upon the respiratory center and does not cause nausea, even after the administration of large doses. Sollman[3] states that Lobelin if injected lowers the carbon dioxide threshold and produces a marked stimulation of respiratory movements. Meyer and Gottlieb[4] state that Lobelin stimulates the respiratory center and may be administered intravenously or intramuscularly to strengthen and increase the respirations. They believe that it is particularly useful in respiratory paralysis during narcosis.*

SUMMARY

1. Asphyxia resulting from shock requires the administration of a quick-acting respiratory stimulant.

2. In all cases of this type, in which Lobelin was administered, respirations became evident and normal within two or three seconds after intravenous injection.

3. One injection was sufficient in all cases and no further means of treatment, such as oxygen or artificial respiration, were necessary.

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* The Lobelin used in these experiments was manufactured by Ernst Bischoff Company of Ivoryton, Connecticut, and is known commercially as "Lobelin-Bischoff."

Case Reports

MADELUNG'S DEFORMITY IN SISTERS*

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I WISH to report the occurrence of Madelung's deformity in sisters with a brief survey of this rather unusual deformity.

CASE REPORTS

CASE 1. Clara C., unmarried colored girl, age forty, was first seen at the Orthopedic Clinic of the New Rochelle Hospital in January, 1942. Her chief complaint was stiffness of her fingers for the past three months. The condition first began in the right hand and later spread to the left. The primary pathological condition was an acute arthritis of her hands and wrists, but during the course of the examination, the prominence of the ulnae suggestive of Madelung's deformity, was recognized.

The patient's wrist gave no trouble during childhood or adulthood until about three years ago at which time her wrists began to ache after heavy lifting or prolonged washing of clothes. As far back as she could remember the lower ends of the ulnae were prominent. It was her painful arthritis that brought her to us. The Madelung's deformity was only an incidental finding.

Menstrual history was regular, twenty-eight day cycle, lasting five or six days. Quite recently her periods increased to nine days. Examination at the hospital revealed a fibroid uterus as the cause.

The patient has five brothers and one sister. Her parents and three brothers are dead and she has lost track of the remaining two brothers. The only relative she has contact with is her younger sister, described below as Case II. However, she never did notice any prominence of the wrists of any of the other members of her family.

Examination of the wrists revealed a prominence of the lower ends of both ulnae somewhat more marked on the left. (Fig. 1.) The right hand appears to be displaced ventrally. This is the so-called "bayonet deformity." This apparent displacement is not as marked on the left side. There is an old scar on the dorsum of the right hand caused by a childhood injury and irrelevant to the present deformity. The fingers of both hands are held in marked flexion with swelling of the interphalangeal joints. This flexion is the result of an acute arthritis unrelated to Madelung's deformity.

Motion of the right wrist is restricted to about 10 degrees of activity. The fingers are flexed to almost 90 degrees with very little phalangeal motion. Abduction and adduction of the hand are practically zero. Pronation 45 degrees from a neutral midline position; supination 45 degrees. Most of this restriction is on an arthritic basis.

Motion of the left wrist shows dorsiflexion of 45 degrees, palmar-flexion of 30 degrees; adduction (ulnar deviation) 30 degrees, abduction (radial deviation) 5 degrees. Pronation 70 degrees from a neutral midline position; supination 60 degrees.

Sensation is normal in both upper extremities and *x*-rays have ruled out cervical ribs.

Sedimentation Rate (Rourke method): Normal is 0.08 to 0.35 mm. per minute. On April 1, 1942, it was 0.62, on April 13, 1942, 0.65.

Blood count on March 31, 1942, was as follows: White blood cells, 6,500; red blood cells, 4,520,000; hemoglobin, 89; color index, 0.9; polymorphonuclears, 46 per cent; unsegmented, 0; eosinophiles, 2 per cent; basophiles, 0; lymphocytes, 38 per cent; large mononuclears, 14 per cent. A blood Wassermann (April 2, 1942), showed 4 plus c̄ cholesterinized

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antigen, 1 plus c̄ acetone insoluble antigen. The patient had had antiluetic therapy three years ago.

("bayonet deformity"). All these changes were more marked on the left side. The grip of her hand was quite strong on both sides.

FIG. 1. Case 1. Note the prominence of the ulna at the wrists. The superimposed arthritic deformity is clearly discernible.

X-ray examination of the wrists and hands (Figs. 2 and 3) revealed marked prominence and dorsal displacement of the lower end of the ulna; a pseudoventral displacement of the hand ("bayonet deformity"); downward and ulnarward tilt of a triangular lower radial epiphysis and a pyramid-shaped carpus (pyramidalization) with its apex at the lunate (semilunar) bone. The changes noted were present about equally on both sides. They are typical of Madelung's deformity. There was also a small osteophyte noted on the lower end of the right radius abutting against the ulna. (Fig. 2.)

CASE II. Leola C., unmarried colored girl, age twenty-three, came to the Orthopedic clinic at the New Rochelle Hospital in March, 1942, complaining of a mild sprain of the right wrist. Upon examination the deformity of her wrists was promptly detected and the fact noted that she was a sister of the above described patient. (Case 1.) Prior to the present injury her wrists had never given her any trouble, although they were prominent as far back as she could remember.

Except for her family history (described above in Case 1) the only other relevant fact was an irregular menstrual history. Onset occurred at fifteen years of age; irregular twenty-eight day cycle, duration two to three days but at times as long as four to five days with occasional menorrhagia.

Examination of the wrists revealed a marked prominence of the lower end of both ulnae. There was dorsal bowing of the forearms while the hands appeared to be displaced ventrally

Motion of right wrist showed dorsiflexion 45 degrees, palmar-flexion 70 degrees; radial deviation (abduction) 5 degrees; ulnar deviation (adduction) 35 degrees; pronation from the neutral midline 80 degrees; supination 30 degrees.

Motion of the left wrist showed dorsiflexion 45 degrees, palmar-flexion 60 degrees; radial deviation (abduction) 5 degrees; ulnar deviation (adduction) 35 degrees; pronation from neutral midline 80 degrees, supination 80 degrees.

X-ray examination of the wrists and hands (Figs. 5 and 6) revealed the typical changes of Madelung's deformity. On the right side there was a slight ventral turning down of the lower end of the radius with prominence of the ulna, and pseudoventral displacement of the hand. The dorsal view disclosed the typical pyramid-shaped carpus, with the radial epiphysis sloping ulnarward about 45 degrees. On the left side there were similar changes with the lower end of the radius markedly ventrad and marked prominence of the lower end of the ulna. In addition there was a small cystic area at the lower end of the left radius.

Definition. Madelung's deformity is essentially a growth disturbance of the lower radius resulting in dorsolateral bowing of that bone with ventro-ulnar deviation of the hand at the wrist and a concomitant prominence of the lower end of the ulna. In 1878, Madelung[1] focused attention on this clinical entity by describing the

autopsy findings in a woman of twenty and mentioning twelve other cases which he had seen. It is noteworthy that Madelung's description of this condition appeared almost two decades before the advent of *x*-ray.

FIG. 2. Case 1. Right hand. Note tilting of lower radial epiphysis, obliquity of lower end of radius on dorsal view, the pyramid-shaped carpus, and the dorsal position and prominence of lower ulna. Note particularly the osteophyte at the lower end of the radius abutting on the ulna.

FIG. 3. Case 1. Left hand. Changes similar to the right side.

Incidence. While the European literature on Madelung's deformity is quite extensive, American reports are by no means as abundant. The first American report was by Pooley[2] in 1880. He was evidently unaware of Madelung's work and described the condition independently. An extensive and excellent survey was made by Anton, Retez, and Spiegel[3] in 1938. They thoroughly analyzed 171 authentic cases reported up to that time. Of this number only twenty were American cases to which they added the twenty first.

Sex Ratio. There is a preponderance of females in the ratio of 4 to 1.

Involvement. About 75 per cent of the reported cases are bilateral. Among the bilateral cases it is usually the right side which is apt to be more severely involved. When both sides are affected, one side is involved somewhat earlier than the other. Of the unilateral cases the incidence of the side involved is about equally divided.

Age. The condition starts during adolescence between the ages of ten and fourteen. Progress of the deformity ceases with the termination of normal growth at the wrist. By the age of twenty-five it is safe to assume that the deformity is stationary. This is very important in therapy.

Heredity. Heredity is said to be a factor in about one-third of the reported cases. I have personally seen about ten cases over a period of many years. I do not recall any hereditary factor with the exception of the two above reported cases.

Cause. Occupation and environment are not etiological factors. While trauma may injure the lower radial epiphysis with resulting deformity, a genuine Madelung's is nontraumatic. Rickets may be dismissed by the fact that these cases show no signs of rickets in other parts of the body.

The pressure of cervical ribs has been suggested[4] but this idea may be discarded as exceedingly few of these cases have cervical ribs. By *x*-ray and clinical examination my two patients were free of cervical ribs.

Ovarian dysfunction[5] has been advanced as a possible cause. Certainly the vast number of women with ovarian dysfunction ought to produce more than a mere handful of Madelung's cases.

The most likely explanation of Madelung's deformity is on the basis of a dyschondroplasia of the lower radial epiphysis. This has been suggested by others[3] because of the rarity of the condition, uniformity of the age of onset during the secondary growth period, its tendency to bilateral occurrence and the absence of a traumatic history or the stigma of rickets.

Symptomatology. With insidious onset the condition first begins in one wrist during early adolescence at about thirteen years of age. Pain and deformity about the wrist are the main symptoms. Pain at times may be very mild and usually ceases with the termination of wrist growth at about twenty-five years of age. There is apt to be some limitation of wrist motion although this is mild and in proportion to the extent of actual deformity.

Wrist deformity is the cardinal complaint. The articular face of the lower radius (really the epiphysis) turns downward (ventrally) and carries the wrist and hand along with it. The lower end of the radius bends to accommodate this change so that a dorsal radial bowing of the shaft results. There is an apparent pseudodislocation of the wrist, the so-called "bayonet deformity." There is concomitant lateral bowing of the radial shaft with a widening of the interosseous space. As the lower radius turns downward the ulna continues its normal straightline growth and consequently becomes very prominent. It is this prominence of the lower end of the ulna that very often calls our attention to the painless, hitherto unrecognized case of Madelung's deformity.

In addition to the above changes the lower radial epiphysis fuses prematurely at its inner (ulnar) side. The outer side of the radial epiphysis continues to grow and throws the wrist and hand into adduction (ulnar deviation).

Joint restriction naturally varies with the extent of mechanical deformity. Flexion of the wrist is apt to be increased with extension limited. Adduction (ulnar deviation) tends to be increased with abduction (radial deviation) limited.

There is a "reverse Madelung" deformity in which the lower radius and hand turn upward while the ulna displaces ventrally. This deformity is exceedingly rare as there are only five cases described in all the literature.[3]

FIG. 4. Case II. Note the broad wrists, prominent ulnae and "bayonet deformity."

Roentgenologic Picture. Although Madelung described this condition long before the advent of *x*-rays, it is only by a careful study of the film that we can really understand this condition.

The following criteria have been described as important:[6]

1. The radial shaft arches dorsally and laterally. The dorsal bowing carries the distal end (including the epiphysis) downward. The lateral bowing is really an increase in the normal curve of the radius. This increases the interrosseous space and is best viewed in the anteroposterior film with the hand and forearm flat on the plate in full pronation. The actual length of the radius is shorter than normal.

2. Premature fusion takes place at the inner (ulnar) side of the lower radial epiphysis. The epiphysis assumes a triangular outline with the apex situated medially (ulnarward). The lateral half of the epiphysis continues to grow pushing the hand into ulnar deviation (adduction). The articular surface of the lower radius faces internally (ulnarward) and ventrally (palmarward). On lateral view the lower end of the ulna

grows forward normally and eventually assumes a prominent position dorsal to the radius. In a so-called "reverse Madelung" itself justify operative surgery. Temporary immobilization and physiotherapy to the wrist should be sufficient to tide one over

FIG. 5. Case II. Right hand. Note pseudo-dislocation of the hand ("bayonet deformity"), oblique lower radius, prominent dorsal ulna and pyramidal carpus.

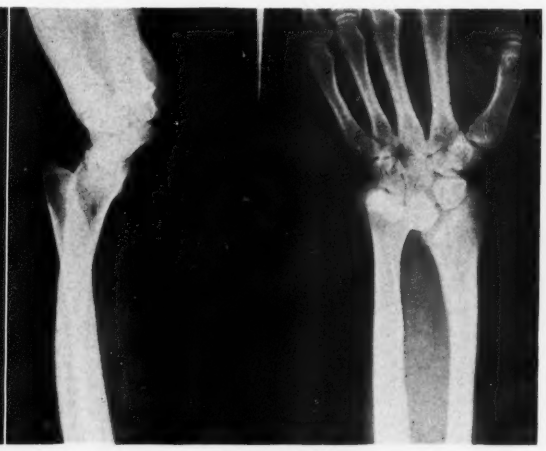

FIG. 6. Case II. Left hand. Changes as in right hand but more marked. Note particularly in the lateral view the cystic area in the lower radius about half an inch above the wrist joint.

the ulna lies ventral with the wrist and hand dorsal.

3. The carpus becomes wedged between the deformed radius and protruding ulna and assumes a triangular appearance with the os lunatum (semilunar) at the apex. This has been called the "pyramidalization" of the carpus.

4. Bony excrescences or even definite exostoses may be present along the ulnar border of the lower radius. In addition an area of bone absorption on the ulnar border of the radial metaphysis may be present a variable distance above the epiphyseal region. This exostosis (Fig. 2) and cystic area (Fig. 6) may be seen in the above cases.

TREATMENT

In considering therapy we must remember that the condition actively progresses until growth ceases. Pain, if present at all, stops with cessation of wrist growth. Consequently, pain, unless very severe which is not apt to be the case, does not by the active period of active growth. Any corrective surgery performed during this growth period is likely to become nullified and may have to be done over again.

When growth ceases—and we can consider twenty-five years to be the safe age—a corrective wedge osteotomy of the lower radius and a resection of the lower end of the ulna are the indicated surgical procedures in cases of marked deformity.

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MYOCARDIAL ABSCESS WITH PERFORATION OF THE HEART FOLLOWING STAPHYLOCOCCAL PYEMIA*

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THE record of one case of myocardial abscess with perforation of the heart and a review of the literature concerning this condition is included in this report. This case is of interest not only because the condition is rare, but also because of the management. The history was misleading and not complete, and the initial diagnosis certainly influenced the treatment thereafter. Possible methods of treatment that may have been instituted earlier were not given an opportunity to prove their value.

CASE REPORT

S. P., aged six years, was admitted to Provident Hospital on July 23, 1941, with a history of attacks of pains in his joints and frequent colds. Early on the morning of the day of admission the child was unable to walk, seemed delirious, and mother had to lift the child out of bed. During the afternoon the child attempted to stand and was unable to do so. He complained of severe pains in the region of his left knee.

The history of the patient prior to admission revealed frequent colds during the winter season, and headaches from time to time that often lasted the entire day. The child obtained some relief from the latter attacks following medication of aspirin. He had measles during the early part of June, 1941, from which recovery was supposedly uneventful. The habits of the patient were good except that he refused to eat when ill. The family history was not unusual.

Physical examination revealed a fairly well developed and a well nourished negro child. Head, neck, eyes, ears, and nose were essentially negative. Lungs were normal. On admission a loud systolic murmur was heard in all the valve areas with the greatest intensity at the apex. An occasional extrasystole was heard. The heart was normal in size and position. The abdomen and the genitalia were essentially negative. The left knee felt warm, was markedly tender on palpation, and considerable pain was caused by attempted motion. A small discolored area about ½ cm. in diameter was noted on the medial aspect of the left leg at the level of the inferior border of the patella. The latter was not considered significant at the time. Reflexes were hyperactive. The temperature was 104°F., pulse 130, and the respirations 30 per minute. Blood count showed 3,560,000 red blood cells, and 12,050 white blood cells per cu. mm. with 71 per cent hemoglobin. Differential showed 86 per cent neutrophils. The sedimentation rate was 19 mm. in one hour. The Wassermann reaction of the blood was negative. Except for traces of albumin and sugar, the urinalysis was essentially negative. The diagnosis at this time was acute rheumatic fever.

On the day of admission the patient was given an enema, placed on a liquid diet, and received 10 gr. of aspirin. On July 24th, large wheals were noted over the right side of his face. It was believed that this was an allergic reaction, and the aspirin was discontinued. Adrenalin (4 m.) was given followed by the same dose fifteen minutes later. In less than two hours the wheals disappeared. Temperature dropped to 103°F., pulse 130, and respirations increased to 40 per minute. Stools were soft, brown in color and positive for blood. The patient received 30 gr. of sulfathiazole and an order was left for 7½ gr. sulfathiazole every four hours until temperature remained normal for thirty-six hours. On July 25th, an erythematous rash was noted over the entire body, the tonsils and throat appeared injected, the left knee was swollen and more painful with some evidence of induration in the region of discolored area. The tuberculin test was negative. Examination showed no evidence of

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any systolic murmur and no evidence of any extrasystole at this time. Heart findings were normal except for rapid rate. Temperature at

Fig. 1. Posterior view of the heart showing the area of rupture in the left ventricle near its junction with the left auricle.

one time reached 104.8°F., pulse 168, and respirations 42 per minute. Blood count showed 3,600,000 red blood cells, 25,100 white blood cells, with 71 per cent hemoglobin. The differential showed 88 per cent neutrophils. The patient became more delirious and had to be restrained. Tepid baths were ordered. Sulfathiazole was discontinued after two doses. Sulfanilamide (30 gr.) was given at 3:50 P.M., and sulfanilamide (5 gr.) was ordered four times a day.

On July 26th, the temperature ranged between 103.2° to 101.6°F. going down to 100.4°F. at midnight. The patient was quite restless, pulse rate remained above 120 and respirations between 30 and 60 per minute. Blood count showed 3,380,000 red blood cells, 18,500 white blood cells, with 78 per cent hemoglobin. There was marked evidence of edema of the tissues about the left knee joint, which was very warm and markedly tender. The abdomen was also tender on palpation. The erythema noted over the body, the face, and the extremities presented some bizarre shapes. After two doses of sulfanilamide (5 gr.) were given the order was discontinued, and sulfanilamide (10 gr.) with 10 gr. of sodium bicarbonate every four hours was ordered. A hypodermoclysis of 500 cc. of normal saline was given.

Fig. 2. Section through the left ventricle wall showing extent of the abscess in its upper part. The external opening plugged by a blood clot and the ragged appearance of the endocardium in the region of the internal rupture can be easily made out.

On July 27th, surgical consultation was sought. At this time the abdomen was found to be slightly distended. The left knee was swollen and tender. No surgical measures were instituted. Temperature on this day dropped to 99.2°F., at 4 A.M. and rose steadily to 103.4°F. at 12 noon. Pulse remained above 120, and respirations between 30 and 42 per minute. Sulfanilamide with sodium bicarbonate was discontinued and 10 gr. of sodium salicylate with 10 gr. of sodium bicarbonate was ordered every four hours.

On July 28th, the general appearance of the patient had not changed. The temperature was 102°F., pulse remained above 120, with respirations 50 per minute. Blood count showed 18,500 white blood cells and 64 per cent hemoglobin. A blood culture at this time showed a forty-eight-hour pure culture of Staphylococcus aureus. Following the latter report, the sodium salicylate was discontinued and 5 gr. of sulfanilamide three times a day was ordered.

On July 29th, the condition of the patient remained the same.

On July 30th, blood count showed 4,100,000 red blood cells, 22,600 white blood cells, with 81 per cent neutrophils, and a hemoglobin of 71 per cent. The patient was transferred to surgery because of extensive cellulitis about and below the left knee. A small amount of yellowish purulent material exuded from a small opening at the medial aspect of the left knee at the level of the inferior portion of patellar bone. The inguinal glands were swollen and tender on palpation. A diagnosis of acute osteomyelitis was made and an *x*-ray of the left knee was ordered. Temperature remained around 103°F., pulse above 130, and respiration about 40. The patient became quite incoherent and sulfanilamide was discontinued on July 31st. *X*-ray showed no demonstrable evidence of any bone disorder.

On August 1st, the temperature ranged between 101°F., and 103°F., pulse above 120, and respiration between 30 and 40 per minute. Scattered râles were heard in both lung fields. Heart findings were normal. The opening over left knee seemed larger and more pus was escaping.

On August 2nd, the child's condition remained about the same. On August 3rd, the general condition seemed improved except for some swelling and tenderness of the fourth finger of the left hand.

On August 4th, warm boric acid compresses were applied to the left leg continuously. A large ulcer 2 cm. in diameter extending down to the periosteum of the bone was noted in the position of the discolored area first seen on admission. The patient was quite restless during the night. At 3:25 A.M. on the morning of August 5th the patient asked the nurse on duty for a drink of water. After he drank the water, the nurse returned to her desk about twenty-five feet away, picked up a tray to go back to the patient's bed. On reaching the bed the nurse noted that the patient was apparently lifeless. Death had taken place almost instantaneously.

Postmortem examination revealed the following: A large ulcer with a diameter of 3 cm. was noted at the level of the inferior border of the patella bone on the medial aspect of the left leg. The edge of the ulcer was ragged and showed evidence of extensive necrosis of tissue. The ulcer extended to the periosteum that was somewhat thickened and not raised. The bone showed no macroscopic evidence of any pathological condition. Incision through the soft tissue along the tibia revealed numerous pus pockets between the muscle sheaths and the periosteum. Purulent fluid was noted in a channel along the medial border of the tibia outside the periosteum extending to the lower third of the leg. It followed the lines of least resistance in the fascial spaces.

The pericardial sac was markedly distended. The parietal surface was ragged in appearance and discolored. Numerous adhesions were noted between the pericardial sac and the lungs. The pericardium was thickened and the sac contained about 300 cc. of fluid blood and blood clot. The blood clots were both of chicken fat and of currant jelly type. The visceral pericardium was rough and discolored with old organized blood, which was removed from the serous surface with difficulty.

The heart weighed 180 Gm. The epicardium was covered with a ragged material resembling organized blood that was removed with the greatest difficulty. The epicardium was studded with abscesses both small and large that followed the vascular distribution over the heart. A rather large opening plugged by a blood clot was noted on the posterior aspect of the left ventricle just beneath the coronary sulcus. A probe was easily passed through this opening into the left ventricle. The internal opening was beneath the posterior mitral cusp. On insertion of the probe a yellowish pus escaped from the abscess cavity. Section showed that the abscess had spread in several directions from a central focus with only a thin layer of muscle fibers intact on either side. Adherent old blood clots were removed with difficulty from mitral valve leaflets revealing grossly normal structures.

The lungs were adherent to the chest wall, and nodular in appearance due to large peripheral abscesses. Pus was noted in pleural cavities. Several of the abscesses had ruptured into the pleural cavity. Many of the larger abscesses had coalesced. Numerous minute abscesses seemed to follow the course of the smaller blood vessels over the periphery of the lungs. Section revealed abscesses scattered throughout the substance of the lungs, with the larger abscesses near the surface. Some abscesses were multilocular while most were single and discrete. The abscess walls were

friable and contained a cheesy purulent substance. The largest abscess measured 2 cm. in diameter.

The spleen weighed 160 Gm. The organ was soft and greyish pink in color. The pulp protruded from the cut surface, but could not be wiped away with the knife.

The liver weighed 600 Gm. It was bound to the diaphragm in places by dense adhesions. The capsule was rather adherent. One large abscess was noted over the superior surface of the right lobe of the liver and ruptured when adhesions between the liver and diaphragm were broken up.

The pancreas and the gastrointestinal tract did not show any marked gross pathological disorder except for petechial hemorrhages scattered over the mucosal surface of the stomach and the small intestines. These hemorrhages followed the blood supply. Practically all of the lymph glands seen were enlarged and palpable.

Both kidneys were enlarged. The capsules were removed with difficulty. Numerous small yellow abscesses were noted over the surface of the kidneys. In the cortex of the right kidney an abscess with a diameter of 0.2 cm. was noted on the anterior surface near the lateral border. The medullary portions of the kidney showed fewer abscesses that were pin-point in size.

A well organized thrombus was noted in the descending aorta near its bifurcation. It extended into the left common iliac artery.

Several palpable posterior and lateral cervical glands were noted on the left side of the neck. Tonsils were removed for histological study. The head was not examined.

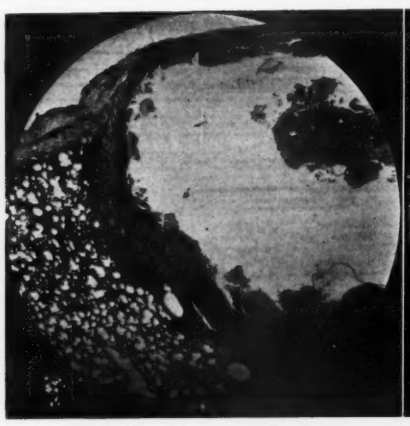

FIG. 3. Microphotograph showing a part of a large abscess of lung just beneath the visceral pleura covering the lung. Some of the necrotic tissue can be seen within the abscess cavity. × 8.7 (Van de Grift's fixative).

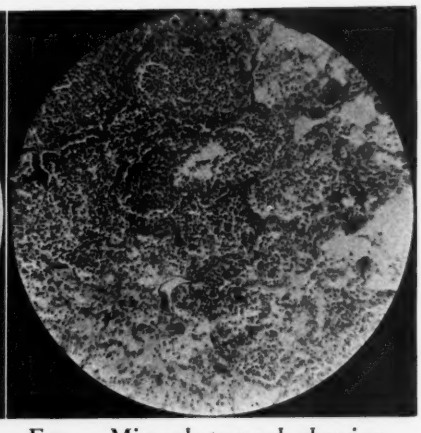

FIG. 4. Microphotograph showing numerous small abscesses of the lung with the replacement of normal tissue by collections of inflammatory cells and débris. Collections of serum within many of the bronchioles and aveolar spaces can be seen in places. × 87. (Van de Grift's fixative).

Culture of some purulent material from several of the abscess cavities and from the blood in the cardiac cavity revealed a pure culture of Staphylococcus aureus.

Microscopic examination showed marked infiltration of neutrophils in the myocardium surrounding the ruptured area, with necrosis of adjacent heart muscle. Thrombi in several of the small vessels showed neutrophils and macrophages. The lungs, spleen, liver and kidneys also showed findings typical of an extensive pyemia. The periosteum at the base of the ulcer showed evidence of necrosis and numerous foci of neutrophils, lymphocytes and macrophages. Section of bone beneath showed widely scattered foci of inflammatory cells. Tonsils showed chronic tonsillitis and also evidence of a recent acute infection. The peritonsillar musculature showed some evidence of fibrosis. Crypts showed little evidence of desquamation of their epithelium. No evidence of any thrombi noted within the lumina of small blood vessels in the peritonsillar tissue. Section through the ulcer showed marked diffuse neutrophilic infiltration with extensive cloudy swelling and necrosis of tissue. The smaller vessels were occluded by thrombi that contained neutrophils, lymphocytes and macrophages.

COMMENT

Abscess of the heart with rupture is a rare condition. It is usually a metastatic manifestation of an overwhelming sepsis. In the older reports there are gross descriptions of the heart with little or no information on the clinical course or the bacteriology.

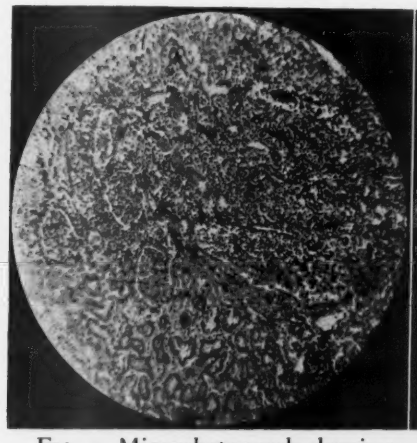

Fig. 5. Microphotograph showing an abscess of the kidney with inflammatory cells infiltrating all adjacent tissue. The glomerular tufts show numerous inflammatory cells invading the capillary walls and their lumina. The greater accumulation of cells is about the arterioles in the region of the tubules adjacent to the glomeruli. × 87 (Van de Grift's fixative).

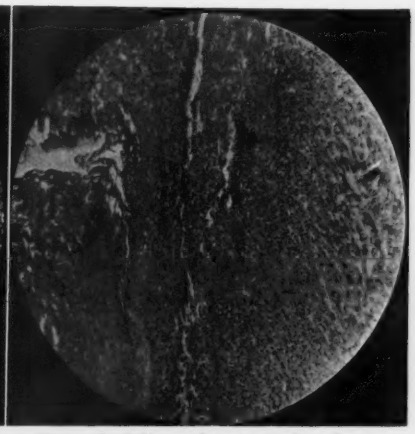

Fig. 6. Microphotograph of section of the myocardium showing infiltration of muscle tissue by inflammatory cells and areas of necrosis. Section was taken in region of the rupture. × 87 (Van de Grift's fixative).

It is almost certain, as was maintained by Morgagni, that a rupture never occurs in a sound heart muscle, the most frequent cause being fatty degeneration or infiltration of the muscles, and occlusion of the coronaries. Less commonly, myomalacia, abscess, gumma, echinococcus cysts and new growths are responsible.

According to Claytor, probably in more than 70 per cent of the cases of spontaneous rupture of the heart, death is instantaneous; but there may be a sense of anguish in the cardiac region with a feeling of suffocation and life may be prolonged for several hours. Osler speaks of seeing a case in which the patient walked up a steep hill and lived for thirteen hours after the rupture occurred, and there is one case, at least, in which the patient survived for eleven hours. It seems likely that the rapidity of death depends to some extent upon the size of the rent and on the manner in which the muscle fibers are separated, i.e., whether the entire thickness of the wall gives way at once or by degrees. Death results from shock or from pressure produced by the overdistended pericardium.

An abscess of the myocardium might rupture into the pericardial sac or into the cavities of the heart, or both. Howitt, in 1846, reported the postmortem findings on a boy, age eight years, who went gradually into coma. It could be assumed that the cause of his ailment was some septic condition. The pericardium was distended and a pint of pus was found in the sac. At the junction of the right auricle and ventricle an abscess was incised containing a dram of pus. The abscess cavity communicated with the right auricular cavity. Whether or not the abscess opened into the pericardium was not stated. Moxon, in 1869, described the case of a boy, age eleven years, who suffered from high fever and delirium. Physical examination of the chest was not made. At postmortem turbid fluid was found in the left pleura. There was an acute fibrinous pericarditis. Several small abscesses were located in the myo-

cardium. One of these had ruptured into the left ventricle. Similar abscesses were found in one kidney and in the bones. The etiology of sepsis in this case was not determined. Haddon, in 1884, published a case of a boy, age six years, who had fallen from some railings, and who complained of pain and swelling of the left foot. Some months later an ulcer developed on the outer side of the left ankle, and two weeks later the patient was admitted to the hospital with signs of pneumonia. Two days after admission he asked to be propped up in bed, gasped and died suddenly. At postmortem there were pyemic abscesses in the liver and kidneys; there was a pericarditis, and the heart had ruptured on the posterior wall of the left ventricle near the auricle. It was never determined finally that there was an actual abscess in the wall. Formad, in 1893, showed a specimen of the heart of a man who died suddenly while diving. In the left ventricular wall posteriorly an abscess was found about the size of a large bean. The pericardium contained seropurulent fluid. Over the pericardial surface several areas of ecchymosis were present. The etiology of the abscess was not determined. Rudolf and Moorhouse, in 1916, reported the case of a soldier, aged twenty, who entered the hospital with normal heart findings, and as a sequence and complication of a single shrapnel wound of the left chest involving the pleura and lung, an abscess formed in the interventricular septum. Subsequently, a short systolic "swish" and a marked, rough diastolic bruit was heard over the second and third costal spaces on the right, close to the sternum. A diastolic thrill was palpated over the same area. At postmortem the pericardium was found to contain a considerable amount of yellowish fluid. The visceral and parietal layers were covered with a fibrinous deposit. A flattened mass of fibrin was lying free near the apex. This mass had the appearance of a partially resolved blood clot. The pericardium was intact. On the inner wall of the right ventricle, whose cavity was greatly dilated, an ulcerated patch was found extending anteriorly from near the medial and anterior leaflets of the tricuspid valves, and burrowing into the wall of the septum was a sinus which opened into the right ventricle near the base of the medial leaflet of the pulmonary valve. There were two openings of the abscess channel in the right ventricle which extended on to the tricuspid and semilunar valves. Burrowing directly through the septum the abscess channel opened into the systemic aorta under cover of the anterior leaflet of the aortic semilunar valve. There was as a result a communication between the systemic aorta and the right heart, with consequent leakage from the aorta into the right ventricle. No bacteriologic examination was attempted.

Goodall and Weir analyzed a series of eighteen cases of rupture of the heart, one being the result of gummatous infiltration of the wall, and the others the result of disease of the coronary arteries.

Stevenson and Marshall, in 1928, reported the case of a boy, aged nine years, who was struck by a stone on the medial aspect of the left ankle. Three days afterward blebs appeared at the site of trauma and the ankle became swollen. Poultices were applied but the condition did not improve. The boy became very ill, and began to vomit on the day prior to admission. Diagnosis on admission was osteomyelitis although there were no obvious signs of bone inflammation. An urgent operation was performed with free incisions into the cellulitic area over the fibula. The subcutaneous tissues were infiltrated with thin, watery pus which was clinically streptococcal in type. Periosteum over the fibula was not raised or much inflamed, and there was no evidence of osteomyelitis of the bone. Following the operation the boy developed numerous swellings in various situations, notably in the abdominal wall and in the parotid regions. Some dullness was noted over the base of the left lung

thirteen days after admission, although the boy appeared to be improving. On the morning following admission, the temperature had dropped to normal, and his pulse, which had been uncountable in the earlier days of his illness was 120. The nurse in charge went in to ask him what he wished for his breakfast, and was informed that he wished an egg. On returning with this a few minutes later she found that he was dead, death having been practically instantaneous. Postmortem examination showed a fibrinous pericarditis of some duration, with the pericardial sac distended with a mixture of fluid blood and pus. On raising up the heart, a small portion of a blood clot was seen to be adherent to a ruptured abscess on the posterior wall of the left ventricle midway between the apex and base. There was a second abscess which had also ruptured toward the base of the left ventricle posteriorly, and a third was present in its anterior wall. The lower of the two posterior abscesses had ruptured both internally and externally, while the other occupied almost the whole thickness of the ventricular wall, though there were still a few strands of muscle between it and the cavity. There was pus in both of the pleural cavities and both lungs were collapsed. Innumerable pyemic abscesses were present throughout the substance of both kidneys. Culture of the pus yielded a pure growth of Staphylococcus aureus.

McLagan, in 1928, reported a case of a fifty-seven year old male, who had suffered from boils and carbuncles in the region of his back and legs for four years prior to admission. After developing a large carbuncle that seemed to respond well to treatment, in the form of free drainage, he developed a generalized sepsis. In this illness he had a "seizure" and collapsed. Postmortem examination showed the pericardial sac filled with a soft clot. A small probe could be passed into the right coronary artery and into a small cavity containing about 1 cc. of pus. No bacteriological studies were made in the case. Death was due to rupture of the abscess into one of the coronary arteries and the pericardial sac, giving rise to a condition which simulated, and was at first mistaken for cardiac rupture.

Krumbhaar and Crowell collected and analyzed 611 cases of spontaneous cardiac rupture, and abscess was mentioned in only three cases. Davenport analyzed ninety-two additional cases with only two as the result of abscess.

Cossio and Berconsky, in 1933, reported the case of a sixty-four year old man, who developed an abscess of the myocardium as a secondary process in a previously infarcted area caused by a primary coronary thrombosis. Three days before coming to the hospital he developed thoracic pain and respiratory difficulty. During his two weeks in the hospital the patient showed signs of bronchopneumonia. Circulatory collapse gradually supervened and he died. Postmortem examination showed a pneumococcic meningitis and a myocardial abscess containing pneumococci. The latter was localized within the old infarcts. It would seem that the infarcted area was thus predisposed to the formation of an abscess.

Weiss and Wilkins made a very interesting report on myocardial abscess with perforation of the heart. A large amount of the material from the same is included in this report. From the hospital necropsy records examined, abscess of the myocardium was noted in thirty-one cases, with bacteriologic data available in twenty-six. Staphylococcus aureus sepsis was responsible in twenty cases, pneumococcus in two, Streptococcus viridans in two cases, Streptococcus pyogenes in one, and meningococcus in one. In the thirty-one cases rupture as a result of the abscess occurred but twice. In the first case, the staphylococcic abscess of the heart probably originated from urinary sepsis. A seventy-three year old male patient for a year prior to admission had some difficulty in urination, occasional incontinence, day and night frequency and had become very

thirsty, taking two gallons of water daily. Postmortem examination showed a rupture of the abscess into the right ventricle as well as into the pericardial sac. In the second case, a seventy-eight year old woman, the myocardial abscess was a direct extension of a small mural pneumococcic vegetation, a complication of bronchopneumonia. In the latter case the abscess was localized in the fat tissue at the junction of the left auricle and left ventricle. This abscess ruptured into the pericardial sac. In neither case did the clinical course suggest sepsis and the unexpected cardiac perforation resulted in a fatal circulatory collapse.

In the case here reported, before the autopsy, mother stated that the child had struck his left knee against a projection on his bed about two weeks before she brought him to the hospital. He complained of pains in that knee from time to time afterward, but the mother saw no lesion and disregarded the incident. This information was not given upon admission of the patient to the hospital. The abscess of the heart was probably a metastatic process resulting from the infection in the region of the left knee.

The clinical signs and symptoms of myocardial abscess with rupture, as noted from the nine cases in the literature and the case reported here, vary considerably. The abscess is symptom free until its rupture that may cause precordial pain followed by circulatory collapse and death within a few minutes or within a few hours. The loud systolic murmur heard on the first day of admission and not heard thereafter is certainly questionable though possible. This case adds another to all of the reported cases of cardiac rupture due to an abscess none of which have been diagnosed clinically.

SUMMARY AND CONCLUSION

A case of myocardial abscess with perforation is described. The abscess caused by Staphylococcus aureus ruptured into the left ventricle as well as into the pericardial sac. The clinical course following an injury to the left knee suggested sepsis, although this was not given much consideration on admission. The unexpected cardiac perforation caused the fatal circulatory collapse.

Although in cases of sepsis, abscess of the myocardium is not unusual, perforation of the heart as a result of an abscess, however, is quite rare. Nine cases collected from the literature are described. A diastolic murmur was heard in two of the ten cases. From the ten cases now available it is still possible to state that myocardial abscesses are symptomless until their rupture. At that time there may be precardial pain followed by collapse of the circulation.

From a theoretical point of view it would have been of interest to have learned the outcome of this reported case, if early free surgical drainage about the lesion on the left knee had been attempted, and adequate sulfonamide therapy instituted.

(I wish to express my appreciation for suggestions by Maj. Walter C. Merkel, M.C.-U.S.A., formerly at Union Memorial Hospital, Baltimore, Md., and by Dr. Charles R. Drew, of Department of Surgery, Howard University, Washington, D. C.; also for pictures of the heart made by Mr. Kougl, and for preparation of the microscopic sections by Mr. Walker, both in the pathology department of Johns Hopkins Medical School.)

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In the large gaping wounds of the soft tissue of the face, one may be tempted to try closure early by suture. This should never be done before at least temporary fixation of bone fragments, otherwise collapse of the latter will occur, with great deformity and interference with function.

ANNULAR PANCREAS

ACCOMPANIED BY AN ABERRANT PANCREATIC NODULE IN THE DUODENUM

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ANNULAR pancreas although considered a rare anomaly has been reported many times in medical literature. McNaught, in 1933, gave an excellent summary of thirty-nine cases that he had been able to trace in the past literature, and in addition reported a new one. In 1935, this same author reported another case and referred to three more in current literature bringing the total to forty-four. Since then the reports of Cunningham (1940) and Truelsen (1940) have appeared. This paper is to record the finding of still another.

This example of annular pancreas was found at the University of Wisconsin anatomical laboratory in the body of a fifty year old Greek male. The subject came from an institution where he had been committed for eleven years with dementia precox, hebephrenic form. The cause of death was diagnosed as cerebral apoplexy. No clinical history of the case was available but according to institution employees, this patient never suffered from any gastrointestinal disturbances.

Besides the annular pancreas several other anomalies were noted in this body. The spleen was two to three times the usual size. The gallbladder was atrophied and embedded in fibrous tissue filling the fossa. A single stone about 16 by 22 mm. in size was present imbedded in fibrous tissue at the side of the contracted lumen. The latter was not connected with the space containing the stone. The common bile duct and accompanying vessels were enclosed within a very dense connective tissue, and the omentum and transverse colon near the right colic flexure were adherent to the liver. Two small hemangiomas were found on the liver. Both the ascending and descending colons had complete but short mesenteries. The appendix was 13 cm. long and extended in its own mesentery upward on the right of the colon to the right colic flexure. The ascending colon and cecum together were only about 13 cm. long. The cecum was adherent and somewhat retroflexed.

An aberrant pancreatic nodule with a diameter of 15 mm. and a thickness of 10 mm. was found on the dorsal side of the duodenum 30 mm. below the pylorus. Pancreatic tissue, islet cells, and ducts which opened into a pit-like evagination from the lumen of the duodenum were observed on microscopic examination. The pancreatic tissue lay external to the muscularis mucosa while Brunner's glands were located internal to it around the pit-like opening of the pancreatic ducts. Otherwise the latter glands were located in the submucosa. Branch and Gross (1935) reported twenty-four cases of aberrant pancreatic tissue in the gastrointestinal tract and summarized the literature on about 200 other cases.

The pancreas itself was unusually large, measuring 170 mm. from the tail to the right side of the head. The band of pancreatic tissue completing the annulus was firmly fused with pancreatic tissue on both ventral and dorsal sides of the descending part of the duodenum. It measured 20 mm. in width in front of the duodenum and fanned out on the left side of the latter structure to a width of 45 mm. The length of the lobe making up the band was 100 mm., measured from its origin on the right side of the duodenum to its left ventral termination. This structure definitely constricted the duodenum, and both cephalic and caudal to the ring, the latter was dilated.

The duct system of this pancreas when dissected out revealed that the duct from the annular portion joined the main duct of Wirsung just before the latter entered the common bile duct. Several ducts from lobes in the region of the head were found to contribute branches to the main pancreatic duct dorsal to the duodenum. What was probably a small accessory duct of Santorini was also observed connecting the main duct in the neck to the duo-

denal wall in the usual position. However, no lesser ampulla could be located nor could a patent duct orifice be demonstrated by injection. McNaught (1933) have discussed these. A persistence of the left ventral pancreatic bud is thought by the authors to best

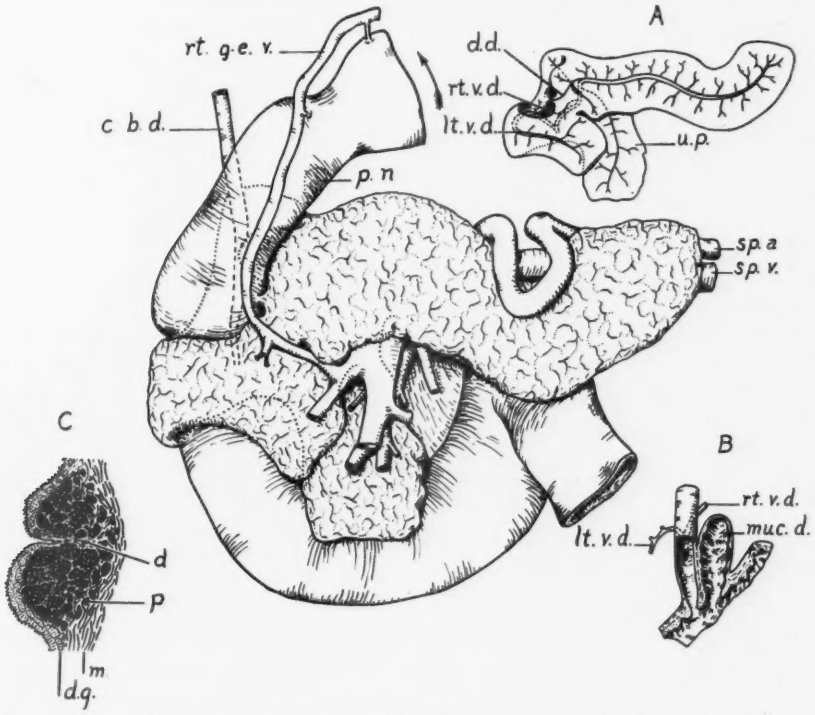

Fig. 1. Ventral view of ring pancreas showing relation to duodenum and superior mesenteric and splenic vessels. First part of pylorus and duodenum rotated upward as indicated by arrow. Mesenteries and superior pancreaticoduodenal vessels not shown. A, diagram of pancreatic ducts. B, duodenal end of the common bile duct and the proximal portions of the right and left ventral pancreatic ducts, showing their relation to the mucosal diverticulum and the wall of the duodenum. There was no papilla major. C, diagram of a section through the pancreatic nodule in the wall of the first part of the duodenum. (Main figure is one-half actual size; others not drawn to scale.)

c, b, d, common bile duct; *d,* duct in pancreatic nodule; *d.d.* dorsal pancreatic duct (accessory or Santorini's); *d.g.,* duodenal glands (Brunner's); *lt.v.d.,* left ventral pancreatic duct, the one normally absent; *m,* muscle layer of duodenum; *muc. d.,* mucosal diverticulum; *p,* pancreatic tissue; *p.n.,* location of pancreatic nodule in duodenal wall; *rt.g-e.v.,* right gastro-epiploic vein, continued below as the inferior pancreaticoduodenal; *rt.v.d.,* right ventral pancreatic duct (main or Wirsung's); *sp.a.,* splenic artery; *sp.v.,* splenic vein; *u.p.,* probably a much enlarged uncinate process.

tion. Of special interest, too, was the lack of an ampulla of Vater. A mucosal diverticulum in the duodenal wall, 20 mm. in length, located just cephalic to the opening of the common bile duct was noted, but this had no connection with the latter structure. Islet tissue was present in the proximal, middle and distal portions of the annular lobe (left ventral), and also in the much elongated uncinate process.

There have been several theories advanced as to the cause of annular pancreas. Baldwin (1910), Howard (1930), and

explain the origin in this case. It is unnecessary and unreasonable to assume the "fixation" of the left ventral bud before rotation of the duodenum to account for the ring, as Lecco (1910) has done. Since the duodenum has such a small diameter relative to the thickness of its ventral and dorsal mesentery at the time the ventral bud contacts the dorsal (10 mm. embryo), there is every reason to believe that in these cases the ventral pancreatic tissue simply spreads dorsally in a subperitoneal

position around both sides of the duodenum, instead of around one side as in normal cases. In fact this condition with three pancreatic ducts and lobes is the normal one in birds (Hill, 1926 and Siwe, 1927).

SUMMARY

1. A case of annular pancreas was found in a fifty year old male.

2. An aberrant pancreatic nodule was present in the duodenum.

3. Islet tissue was present in the annular lobe, in the greatly elongated uncinate process, and duodenal nodule.

4. Other congenital anomalies were a free ascending and descending colon and hemangiomas of the liver.

5. Pathological conditions noted were an atrophied gallbladder with a single stone, an enlarged spleen and adhesions between the liver and transverse colon.

6. The most logical explanation for these cases seems to be a persistence of the left as well as the right ventral pancreatic buds.

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ANORECTAL PAIN DUE TO FOLLICULAR OVARIAN CYST

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ANORECTAL pain is a very common and very distressing complaint. Sometimes the cause can be readily determined during a routine rectal examination; but more often the etiology is obscure and a very careful investigation is necessary before an organic basis can be found. Buie and Brust[1] reported a series of 100 cases of high rectal pain in which the cause was undetermined in seventy-one. Rectal neuralgia was considered the causative factor in 14 per cent of the cases, chronic nervous exhaustion in 26 per cent, and psychoneurosis in 12 per cent. In 19 per cent the cause was not found.

The problem is equally confusing in dealing with cases of anorectal pain. This is not surprising when one considers the wide variety of causes. Gerendasy[2] recently listed the following factors: constipation, foreign bodies, hemorrhoids (thrombosed, strangulated, ulcerated, prolapsed), anal and rectal fissure, fistulas, strictures, cryptitis, papillitis, abscesses; acute inflammation of adjacent structures; gynecological causes such as retroversion, acute Bartholinitis, salpingitis, oöphoritis, perineal tears, abscess in the pouch of Douglas and endometriosis. Daniels,[3] Graham,[4] Lockhart-Mummery,[5] and others, therefore, caution against calling anorectal pain neuralgia or nervous proctalgia, when a true pathological cause can be discovered. For example, referred rectal pain is a common symptom in the general run of gastrointestinal cases, in cystitis, prostatic disease, sciatica, epilepsy, and tabes dorsalis.

The correct diagnosis of anorectal pain presupposes an accurate knowledge of the nerve supply of this region. The anus and rectum are supplied by the second, third, fourth and fifth sacral nerves and the coccygeal plexus. Sympathetic fibers from the hypogastric and the pudendal form a plexus above the level of the levator ani muscle. Thus, the nerve supply of the anus, anal canal, and rectum comes partly from the cerebrospinal and partly from the sympathetic system. The anal canal in the region of the pectinate line and below is abundantly endowed with sensory nerves, and thus the area is extremely sensitive.

The anal sphincter is a law unto itself. Irritation of the sympathetic system causes it to contract, and the only force which will relax it spontaneously is the downward progress of the proper peristaltic wave. The reflexes are numerous and far-reaching, and herein lies the answer to the kaleidoscopic clinical syndromes and clinical surprises in the anorectal region.[6] To quote from Graham:[4]

"An enlarged prostate due to inflammation, hypertrophy or abscess formation, by a downward extension causes painful anorectal sensations. It may be merely a sense of weight or uneasiness, or it may be a most annoying and painful tenesmus. The unyielding character of the prostate sheath, and the nerve supply to the gland, explain the heavy throbbing that is experienced so frequently in the rectum. . . . The intimate connection of the sensory nerves of the pelvic organs with those of the anorectal tissues explains these referred painful sensations."

A large fibroid pressing against the rectal wall may cause severe pain in the anal region. Thus, careful proctological, urological and gynecological examinations must be carried out in all puzzling cases of anorectal pain.

Hill[7] discusses a group of cases in which anorectal pain was associated with organic disease of the nervous system, with pressure on the pelvic plexus by an expanding

growth, with disease of the pelvic bones, coccygodynia and sacroiliac disease.

The case reported below illustrates the difficulty of arriving at the correct diagnosis when the cause of the anorectal pain was extrarectal.

CASE REPORT

H. H., a white female, forty-three years old, single, a nurse by profession, was first admitted to the hospital October 27, 1936, for repeated attacks of lower abdominal pain and rectal spasm. During these attacks she was unable to pass gas and had great difficulty in moving her bowels. This condition had persisted for four years. Attacks occured each month just before menstruation. The abdominal pain and anal spasm diminished as soon as menstruation started. The anorectal pain was less severe when the period was retarded or irregular. The patient complained of inability to push out the rectal contents. The lower bowel seemed to become filled with gas, distending the lower portion of the abdomen. Cathartics failed to relieve the pain. For the last two years, the stools contained mucus and purulent-looking material. At times, a well formed stool was seen coated with thick mucus. Mild diarrhea was present at intervals and blood was observed in the stool on one occasion. The patient reported a loss of eighteen pounds in the past four years.

At the age of fifteen years the patient was operated upon for an acute appendicitis. At this time the right ovary was found to be cystic, enlarged and flabby and was removed.

Tonsils and adenoids were removed and a submucous resection performed for deviated septum in June, 1930. The patient had a proctoscopic examination for rectal spasm and pain October 21, 1935. No diagnosis was made after this examination.

The patient's father died of carcinoma of the stomach. One sister died of carcinoma of the breast. There was no family history of any other chronic diseases.

Physical examination revealed tenderness on deep pressure over the entire lower half of the abdomen, more marked on the left. No mass was felt. It was impossible to insert a finger into the anus because of its tight, unrelaxed condition. The patient complained of severe pain when any such attempt was made. Examination under gas-oxygen-ether anesthesia revealed a uterus enlarged to twice normal size with a subserous fibroid of moderate size on the anterior wall. No pathological disorder was found in the rectum. The patient decided against operation and was discharged untreated.

Attacks of anorectal pain recurred. With the background of carcinoma in the family, the patient had in mind the possibility of cancer of the rectum and became increasingly nervous and unstable. She returned to the hospital February 4, 1937. *X*-ray examination on February 6th showed no organic disorder of the colon or rectum. Several times during the filling of the colon with the barium enema there was marked spasm of the descending colon accompanied by pain sufficient to cause the patient to cry out. A film taken after evacuation showed good emptying.

The examination of urine and blood showed nothing abnormal. The Kahn test was negative. The Benzidine test for occult blood in the stool was slightly positive. Cultures showed no non-lactose fermenting organisms.

On February 10, 1937, the abdomen was opened by a midline suprapubic incision under avertin-ether anesthesia. There was no free fluid present in the abdominal cavity. The gall-bladder was small, bound down in its fossa, but emptied well. The right ovary and tube and the appendix were absent. The uterus was normal in size and showed no pathological condition. It was in first degree prolapse. The left ovary was enlarged and contained a cyst the size of an orange which was lodged in the pouch of Douglas adjacent to rectum and anus. The cyst was excised and anterior fixation of the uterus done. The pathological report was as follows:

The ovary measured 5 by 4 by 2 cm. and was enlarged by the presence of numerous cysts which contained clear fluid. The largest cyst measured 3 cm. in diameter. The stroma was somewhat edematous. There was no evidence of any lutein bodies.

Microscopically, the stroma showed much edema. Most of the cystic cavities were lined by stratified epithelium. There were numerous corpora albicantes, a few of which had a degenerated center.

Diagnosis: Follicular cysts of the ovary.

The patient made a satisfactory convalescence and was discharged from the hospital February 22, 1937, twelve days after operation.

It is now more than six years since operation, and the patient has been symptom-free to date.

COMMENT

It is unfortunate that in this case the correct diagnosis was not made and the proper treatment not instituted until four years after the onset of the anorectal pain. It is important to bear in mind the fact that a tight, unrelaxing anal sphincter may be entirely the result of some disturbance outside the anal canal; in this case an ovarian cyst in the pouch of Douglas exerted pressure on the rectum and anus. The fact that the pain was always more intense just before menstruation did not offer a clue to the etiology. Bacon,[8] however, points out the fact that in rectal and rectovaginal endometriosis pain is always intensified during menstruation.

In the case reported the anorectal symptoms of which the patient complained seemed to be out of proportion to the apparent cause. Even under general anesthesia, with marked relaxation of the sphincter muscle, examination failed to reveal the presence of the ovarian cyst in the pouch of Douglas. The assumed presence of a fibroid uterus seemed insignificant as a causative factor.

In this case the history was significant. The persistent anal spasm, repeatedly diagnosed as neurasthenia, persisted until the beginning of the menstrual period. This spasm had produced a tight, unrelaxed anus. Pressure on the rectum by the cyst caused tenesmus, marked constipation, a sensation as of a foreign body in the rectum, and severe pain in both abdomen and lower sacral region.

Inasmuch as reports of anorectal pain resulting from pressure due to an ovarian cyst in the cul-de-sac of Douglas are few, this case was thought worthy of report. The intimate relation of the sensory nerves of the pelvic organs with those of the anorectal tissues should be kept in mind in the differential diagnosis in cases of anorectal pain.

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VOLVULUS OF THE CECUM AND ASCENDING COLON*

WITH A REVIEW OF THE LITERATURE AND PRESENTATION OF A CASE

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WHEN one considers the embryology of the intestinal tract, it is surprising that volvulus of the cecum and the terminal portion of the ileum does not occur more commonly. The first such case was described by Rokitansky[1] in 1841. Sweet[2] in reviewing the cases of acute intestinal obstruction at the Massachusetts General Hospital from 1873 to 1930, found only six in a series of 520 cases. This series did not include strangulated external hernia. European writers notably Du Roux,[3] and Gatellier,[4] aver that this condition is found more frequently in Russia, Finland, Poland and in Scandinavia. Pratt and Fallis[5] stated that volvulus of the cecum is responsible for not more than 5 or 6 per cent of all cases of intestinal obstruction. In 136 cases of acute intestinal obstruction in the records of the Mayo Clinic,[6] there is one case of volvulus of the cecum.

A study of the last 150 cases of acute intestinal obstruction at Harlem Hospital disclosed six cases of volvulus. Of the latter, one case revealed volvulus of the cecum and ascending colon.

Torsion of the right side of the colon is dependent upon incomplete fusion of the peritoneal layers of these parts. During the embryonal development of the abdominal dorsal mesentery, the cecum migrates from its abode in the left lower quadrant toward the left upper quadrant across the epigastrium and eventually to its final resting place in the right lower quadrant. As part of the final process, the cecum becomes fixed in this site by more or less complete fusion of the peritoneal layers of the ascending colon and cecum. These movements of (1) rotation, (2) descent, (3) fusion of the ascending colon to the posterior abdominal wall may be interrupted at any point, resulting in a developmental variation of the colon. In the course of its rotation the intestinal tract turns 270° anticlockwise about the axis of the superior mesenteric vessels. Of these anomalies, the most common is secondary to failure of fusion of the ascending colon resulting in this structure having a mesentery. As a result of this factor, the mobility of the colon is increased and renders this portion of the intestinal tract susceptible to torsion.

The incidence of occurrence of ascending mesocolon varies considerably as evidenced by reports of Chalfonte[7] 20 per cent Treves[8] 26 per cent Smithe[9] 32 per cent and Harvey[10] 13 per cent. This anomaly is found more frequently in women. It is interesting to observe the frequency with which ascending mesocolon and incomplete rotation of the large intestines are reported in conjunction with retroperitoneal hernias. Volvulus of the right colon is less common than volvulus of the left colon due to the fixation of the right colon normally.

It is agreed that torsion of the intestines upon its mesenteric border must be of at least 180° since pathological changes rarely begin before that stage is reached. The torsion is usually opposite that in which

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the gut normally rotates. Weible[11] reported the torsion to be clockwise in thirty out of thirty-seven cases. Complete colonic obstruction as produced by a volvulus must be as Wangensteen[12] has pointed out, considered as a closed loop obstruction. In nearly all such cases, the venous circulation is disturbed, and there is a tremendous passive congestion which gives way to hemorrhages first into the tissues of the intestines and then into the free peritoneal cavity. As the process continues, strangulation of the gut ensues.

The predisposing factors leading to volvulus of the cecum and ascending colon are: (1) Unusual length of the mesentery; (2) narrow base to the loop of the intestines; (3) a point of adhesion—inflammatory or congenital, at the convexity of the loop which can act as an axis of rotation.

The exciting causes are not well understood. With the above predisposing factors, the following have been suggested as possible precipitating causes: tumors, direct violence, overexertion (running, jumping, weight lifting), habitual constipation, fecoliths, foreign bodies and violent peristalsis (overeating, heavy purgation). Several cases have been reported during the course of pregnancy. Du Roux[3] found volvulus to be common in those people eating coarse vegetable diets. Although ascending mesocolon is noted more frequently in women, volvulus occurs three times more frequently in the male sex. This may be secondary to effort or occupation. A review of the literature reveals that torsion may occur at any age. The youngest case reported is that of a child of four days old and was presented by Borow.[13] However, the disease generally occurs between the third and fourth decade of life.

The symptomatology is essentially the same as that occurring in acute intestinal obstruction. The patient may give a history of several previous episodes associated with habitual constipation, generalized colicky abdominal pain, vomiting, obstipation and constipation, and rapid distention of the abdomen. As pointed out in closed loop obstructions, tremendous distention usually takes place. This cannot be relieved by

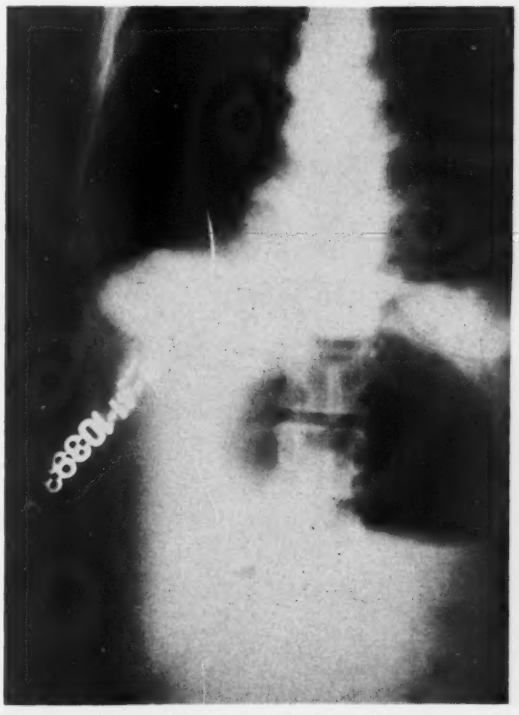

Fig. 1. Scout film of volvulus of cecum and ascending colon.

vomiting, the Levine tube or enema. In the early phases violent peristalsis and increased tinkling may be heard on auscultation. With the progression of distention and compromise of the mesenteric blood supply, signs of peritoneal irritation, tenderness rebound tenderness, rigidity and paralysis of the intestines ensue. The temperature may be slightly elevated. If the patient is in shock the temperature may be subnormal. The leucocyte count is elevated with a marked shift to the left as a result of strangulation of the intestines and hemoconcentration. A rise in the leucocyte count may lead to an early diagnosis of strangulation. The count, however, should be correlated with the condition of the patient's hydration and the abdominal findings of peritoneal irritation. If small intestines are involved in the loop of the compromised gut, vomiting and signs of upper intestinal obstruction occur earlier than in uncomplicated colonic obstruction. However, the

progression of symptoms is much more rapid in a closed loop obstruction involving the cecum and ascending colon, than

Fig. 2. Film taken after two hours of decompression with Wangensteen suction.

in a simple obstruction of the colon. Chemistry studies reveal an elevation of urea nitrogen and low chlorides. The hematocrit shows hemoconcentration.

The diagnosis of a strangulated loop is made on the findings of an intestinal obstruction in association with signs of peritonitis. Roentgenograms are quite helpful in the diagnosis of volvulus of the cecum. Easton and Adams[14] stated "when in the course of a barium enema, the column of barium is unable to pass beyond a certain point distal to the cecum, such as the ascending or transversecolon, (organic lesions being excluded), so that the cecum itself cannot be properly delineated in its haustral markings by the barium, and when at the same time a large collection of gas appears at the site of the cecum, either in the midline or slightly to the right of it, this is an indication that volvulus of the cecum has taken place." The barium serves the purpose of showing an obstruction in the large colon and distended gut, with or without fluid levels will be revealed above this point. As for the diagnosis of volvulus of the cecum, a simple procedure has been worked out in the case we are presenting that may lead to a correct preoperative diagnosis. The observation has been helpful in making the diagnosis of closed loop obstruction both in the large and small gut.

X-rays, flat and upright, are taken on admission. The usual procedure of enema and Levine tube are instituted as part of the treatment of intestinal obstruction. While an attempt is being made to correct the electrolyte loss, another *x*-ray is taken prior to operation. If these *x*-rays are compared, one will note that the gas bubble is essentially in the same position and has the same configuration, the later plate revealing perhaps greater distention. If the *x*-rays (Figs. 1 and 2) are superimposed, one readily notes that there has not been any decrease in the size of gas bubble following attempts of decompression from above by Levine catheter and Wangensteen, and below by enema. This points to a closed loop obstruction. By recognizing the portion of intestines as that of colon by the large fluid levels and haustral markings, and by the position of the colon involved, one can make a diagnosis of closed loop obstruction involving the colon. Inasmuch as sigmoid volvulus (Fig. 3) presents an entirely different *x*-ray picture, one can hazard an interpretation of volvulus of the cecum. The diagnosis is made certain if a barium enema has been given on admission showing the exact location of the distal portion of the obstruction. Acute volvulus of the ileocecal segment must be considered in the differential diagnosis of all causes of acute intestinal obstruction, and vice versa. All types of acute obstruction must be thought of in differentiating volvulus.

However, as soon as the diagnosis is made, there is a definite indication for emergency operation. Signs of peritoneal irritation with intestinal obstruction are indicative of operative intervention without delay. The subsequent course of

therapy depends on the findings at operation. One may be content with simple untwisting of the volvulus with severance of any bands adherent to the loop of intestines. However, this is simply a palliative procedure and the torsion may recur at a later date. Another more feasible procedure in case the involved loop is viable, is a cecostomy and suture of the untwisted cecum and ascending colon to the posterior abdominal wall. It may be necessary to first deflate the dilated loop with a trocar and cannula before proceeding to the fixation. A few interrupted sutures will fix the ascending colon and cecum to the posterior parietal peritoneum followed by the routine cecostomy using a No. 30 Pezzer catheter. In closing the abdominal incision several interrupted sutures include the cecum above and below the cecostomy. After normal function of the bowel is re-established the opening may close spontaneously. In cases of gangrene of the cecum and adjoining ascending colon and ileum, resection must be performed as rapidly as possible. The Mayo's[6] reported two cases in which the most conservative procedure was exteriorization of the entire volvulus. Clamps were applied to the normal bowel on either side and the involved portion was amputated by cautery. Subsequently crushing clamps were applied to the spur between the ileum and colon. When the spur was cut through, the closure of the fecal fistula was effected. If the condition of the patient is not too grave, a resection and primary anastamosis may be performed. We are presenting the latter procedure in the case to follow. Additional therapeutic aid is employed prior to the operation and in the immediate postoperative course are: infusion of 5 per cent glucose and normal saline to restore the electrolyte balance; transfusions of whole blood or plasma depending upon the findings of the hematocrit and plasma protein readings; Levine tube or Miller-Abbott tube with Wangensteen attachment to decompress any distention post-operatively. The mortality rate is definitely related to the rapidity of surgical relief. Chalfont found reports of 119 cases and stated that of twenty-three patients not

Fig. 3. Volvulus of sigmoid.

subjected to surgery, all died. Of the remaining ninety-six who underwent some type of operative procedure, fifty-seven died, a mortality rate of 48 per cent. The total mortality was 67 per cent. Jacobson[15] reported a mortality of 50 per cent in cases in which the exteriorization procedure was carried out.

CASE REPORT

N. N., age forty-one, a colored housewife, was admitted with a history of intermittent abdominal cramps of eight hours' duration. The pain was located in the umbilical region, and the patient vomited bile-stained material twice since the onset of pain. She had a normal bowel movement on the day prior to admission but had not passed flatus since that time. A gradual increase in the size of the abdomen was noted since the onset of her original symptoms. Further questioning revealed minor episodes during the past ten years associated

with habitual constipation. Hemorrhoidectomy had been performed one year before.

Physical examination revealed a middle-aged, colored female complaining of crampy abdominal pain, particularly in the left upper quadrant and the umbilical region. The abnormal findings were limited to the abdomen. Small distended loops of intestines were palpated in the umbilical and epigastric region. Borborygmi were present but visible peristalsis were not noted. Moderate tenderness was noted in the left upper quadrant. Rebound tenderness was not elicited. A stricture permitting the passage of a tip of a finger was found on rectal examination. Temperature on admission was 98°F., pulse 90, respiration 20, blood pressure 110/70, white blood cells 10,400, polymorphonuclear leucocytes 60 per cent, transitionals 10 per cent, lymphocytes 30 per cent, red blood cells 3,900,000. Roentgenograms revealed a large dilated loop of large intestines located in the left upper quadrant. Following the use of a Levine tube with Wangensteen attachment and enema which produced gas and small particles of feces, another *x*-ray was taken. This *x*-ray was essentially the same as that on the previous occasion except that the fluid levels were more distinct. Superimposition of both plates showed the same location and configuration despite a lapse of two hours under decompression measures. Operation was performed eleven hours following the onset of pain.

Upon opening the abdomen through a right rectus splitting incision, 300 cc. of foul-smelling, sanguineous fluid was aspirated. Volvulus of the terminal three feet of the ileum, cecum and ascending colon were noted. The cecum was found in the left upper quadrant. Torsion was in a clockwise fashion and amounted to 720°. No bands or adhesions were found. The mesentery attached to the cecum and ascending colon was long, and the vessels were thrombosed. The right colon was not fixed at any point to the posterior parietal peritoneum. The distended and gangrenous ileum, cecum and ascending colon were delivered, and three complete turns of the mesentery, anticlockwise were necessary to untwist the volvulus. The hepatic flexure, ascending colon, cecum and last five feet of the ileum were severed between crushing clamps. This portion of the intestinal tract was freed from its mesentery and removed from the abdomen. An end-to-side anastomosis was then performed between the ileum and transverse colon. The abdomen was closed in layers with one cigarette drain in the cul-de-sac. The anesthesia used was 20 mg. of pontocaine, introspinally.

A smooth convalescence ensued. Initially, the patient was treated with 5 per cent glucose in normal saline augmented by Wangensteen suction syphonage. The drain was removed on the eighth day. Diarrhea developed on the ninth day but disappeared on the fourteenth postoperative day. The only complication was a small stitch abscess which appeared on the eighth day. She was discharged on the twenty-eighth day.

Three months later the patient had gained ten pounds and had no return of abdominal symptoms. Occasional bouts of diarrhea were controlled by diet and paregoric. The wound was clean, and the patient had returned to her household duties.

Comment. This case illustrates the urgency for immediate operative intervention in volvulus of the ileocecal region. With the rapid and extensive gas formation, strangulation occurs early. The roentgenograms are particularly interesting as a diagnostic aid in recognizing closed loop obstructions.

CONCLUSIONS

1. Volvulus of the cecum and ascending colon occurs infrequently. It depends upon the failure of fixation of the colon.
2. A closed loop obstruction develops with rapid progression.
3. A valuable roentgenographic aid in diagnosing closed loop obstruction has been presented.
4. The procedures of choice of operation are discussed. If the intestines are viable, untwisting, cecostomy and cecopexy is the procedure of choice. If the intestines are gangrenous, a one- or two-stage procedure with resection is indicated.

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THE immediate needs for severe pneumothorax are oxygen, which at times is supplied by the longer, deeper respirations following moderate doses of morphine, or directly by oxygen with a nasal tube, and a release of the collapsed lung from the high intrapleural pressure.

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SEPTIC ABDOMINAL PREGNANCY PAST TERM*

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RECENTLY, several reports have appeared, demonstrating a difference of opinion in the details of the surgical treatment of abdominal pregnancy. Most men are agreed on the method of dealing with the placenta, preferring to leave it *in situ*, when it is attached to an abdominal viscus. Some advocate marsupialization of the sac with gauze packing, and others prefer to close the abdomen without drainage. In addition, discrepancy still exists as to when to operate in those cases in which the fetus is dead. In view of these debatable problems, and the relatively rare occurrence of a septic abdominal pregnancy past term, the following case is reported:

CASE REPORT

The patient was a thirty-three year old colored female, admitted to the Obstetrical Service of Cumberland Hospital on September 9, 1938, with a diagnosis of abdominal pregnancy. Her past history revealed an appendectomy and uterine suspension in 1931. In addition, she had a two months' spontaneous abortion several years prior to admission. She also admitted treatment by the Board of Health for syphilis. Her menses started at fifteen, recurred regularly every twenty-eight days, and lasted four to five days. Her last regular period occurred on December 20, 1937. She stained for one day each in the latter part of January and February, 1938. On March 1, 1938, the patient consulted a local physician, who told her she was pregnant. On March 2, 1938, she began to bleed profusely and passed a large clot and a mass which looked like "liver." She then bled at intervals for one week and finally stopped.

On March 9, 1938, the patient was admitted to the hospital from the Emergency Room with the complaint of cramp-like peri-umbilical pain of two weeks' duration. The only pertinent findings at this time were those relative to the abdominal and pelvic examination. There were no abdominal masses palpable but the abdomen was moderately distended, with a tympanitic note throughout, with tenderness and rebound tenderness, which was most marked in both lower quadrants. The vaginal examination disclosed a cervix which was firm, of normal consistency, closed, directed posteriorly, and markedly tender on motion. The fundus was easily palpable in the anterior position and although it felt enlarged, the exact size could not be mapped out because of the distention and voluntary spasm of the abdominal wall. The lateral fornices presented definite induration which extended posteriorly but did not completely obliterate the cul-de-sac. The indurated area was quite tender. The impression was that of a uterine pregnancy with pelvic inflammatory disease, although extra-uterine gestation was considered. The temperature on admission was 100°F., pulse 80, and blood pressure 106/70. The white blood count was 9,600 with 78 per cent polymorphonuclear leucocytes and 22 per cent lymphocytes. The sedimentation time was twenty-nine minutes. During the next two weeks the abdominal tenderness disappeared and the temperature fell to normal. The patient promptly signed a release and then attended the prenatal clinic.

On September 9, 1938, the patient related that she had not experienced any fetal movements for the past two weeks and had lost three pounds during that interval. The abdominal examination disclosed a cystic mass arising from the pelvis about the size of a six months' gestation, and situated more to the right side of the abdomen. In addition, a hard mass was felt, arising from the pelvis to about two fingers' breadth above the symphysis and slightly to the left of the midline. In the right upper quadrant, a fetal skull was easily palpable, just beneath the abdominal wall. On vaginal examination, the cervix was found soft, closed,

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nontender, and continuous with the hard mass on the left side (felt abdominally) about the size of a six to eight weeks' gestation and distinctly separate from the cystic mass in the right lower quadrant.

On the evening of the day of admission, the patient's temperature was 100.8°F., and for the next few days about 101°F. On September 14th, she developed rebound tenderness throughout the entire abdomen, the temperature reaching 104°F. Her hemoglobin was 62 per cent, and the white blood count was 10,000 with 72 per cent polymorphonuclears, 18 per cent lymphocytes, 4 per cent eosinophiles, 4 per cent monocytes, and 2 per cent basophiles. The patient was given several small blood transfusions and neo-prontosil to improve her general condition and surgical intervention was withheld until the intra-abdominal infection had subsided. The expected date of confinement was September 27, 1938, and about one week prior to this date, she passed two pieces of tissue vaginally, which grossly appeared to be a cast of the uterus and histologically revealed degenerated and infected decidua.

On October 27, 1938, a laparotomy was performed under nitrous oxide-oxygen, and ether anesthesia. A midline suprapubic incision from the symphysis to the umbilicus was made, excising the old abdominal scar. The peritoneum was opened in conjunction with the anterior wall of the amniotic sac which was ⅛ inch thick and contained a small macerated fetus 40 cm. in length and weighing 2 pounds, 10 ounces. The sac was adherent to the anterior abdominal wall, laterally to the sigmoid, and posteriorly to the parietal peritoneum and small intestine. The placenta was situated on the right side of the abdomen and firmly adherent to the small intestine, the right lateral pelvic wall, and in part to the anterior abdominal wall. An extra-ovular blood clot 15 by 10 by 5 cm. was found in the right iliac fossa and easily shelled out through an opening in the sac above the placenta. The fetus was removed after enlarging the incision in the sac and aspirating the brownish amniotic fluid. This fluid was nonodorous and its cultured contents were reported negative for organisms. The sac was then marsupialized after trimming its edges sufficiently to permit approximation to the anterior parietal peritoneum and wound edges by chromic interrupted sutures. The placenta was not disturbed because of its firm attachment to the abdominal wall and small intestine. The umbilical cord was shriveled and string-like and separated from the placenta. The marsupialized sac and placenta was packed with plain gauze, and a light gauze packing was placed in the pelvis emerging from the lower angle of the wound. The uterus was found to be of about normal size, shape, and consistency, and a pedunculated fibroid 3.5 by 2.5 by 2.5 cm. coming off the fundus was removed after ligating its pedicle. The tubes and ovaries could not be identified readily and rather than invite hemorrhage by exploring, the abdominal wall was closed in layers after placing a Penrose drain in the general peritoneal cavity. A culture was taken from the peritoneal cavity and was reported after forty-eight hours as showing Staphlococcus pyogenes aureus and Streptococcus nonhemolyticus. The patient had a slight reaction with the temperature reaching 101°F. on the first and second days postoperatively and from the third day on the temperature was normal. The drains and packing were gradually shortened until final removal. The drainage, moderate in amount, continued from the sac until November 27, 1938, when a piece of tissue was discharged, and then lessened in amount, but continued even after January 5, 1939, when the patient was discharged two and one-half months postoperatively. The wound edges were almost entirely healed and there was very slight drainage for an additional week at home.

The patient, after this time, failed to return to the clinic and because of several changes in address could not be followed. However, in April, 1940, she was finally located. She had no symptoms referable to any gynecological pathology and was menstruating regularly every twenty-eight days with pain. On April 27th, abdominal examination revealed a well healed midline subumbilical scar with no evidence of ventral hernia. Vaginally, the outlet was normal. The cervix was posterior and of normal consistency. The uterus was normal in size, anterior, freely movable, and nontender, but the adnexae were not palpable. A hysterogram was done at this time and revealed bilateral tubal closure at the uterine junction.

DISCUSSION

This case of abdominal pregnancy is presented for several interesting reasons.

We observed this case when admitted early in her pregnancy, at which time she showed signs of an extra-uterine gestation which had ruptured. Since the fetus continued to grow after this episode, we have the right to assume, first, that this was a secondary abdominal pregnancy, and its location originally was near or at the fimbriated end of the tube. The clinical course, abdominal and pelvic findings led us to the diagnosis of intra-uterine pregnancy, associated with acute pelvic inflammatory disease. Extra-uterine pregnancy was not, however, ruled out.

The patient's condition was good and she was followed in our prenatal clinic. Immediately upon final diagnosis of abdominal pregnancy, the patient was hospitalized but unfortunately she began to run a temperature of between 103 and 104°F., signifying intra-abdominal infection and we preferred to wait until her infection subsided before subjecting her to a laparotomy. About one week before her expected date of confinement, the patient had false labor and passed a decidual cast of the uterus. Incidentally, with waiting, we experienced very little hemorrhage during the operation and the placental circulation in the cord, which was atrophied and thread-like, was entirely absent. The placenta was left *in situ* because of its firm attachment to the small intestine. The sac was marsupialized and the abdomen drained because the patient had several weeks of sustained septic temperature apparently due to the infected sac contents. Two days after operative intervention, the temperature was normal, but the drainage from the sac continued for about ten weeks in all. Follow-up on the patient reveals no incisional hernia and lipiodol injection of the uterus fails to show filling of either tube with the radiopaque material.

ACUTE THYROIDITIS COMPLICATING SCARLET FEVER*

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INFLAMMATION of the thyroid gland is unusual but by no means rare. It has been reported complicating the puerpuerium, typhoid fever, diphtheria and other infectious processes. The rich blood supply of the gland might be a factor for its not occurring more often.

The cases reported have fallen into two groups; those which progress to suppuration, requiring incision and drainage; and those with inflammation without suppuration which usually subside with conservative measures. Since the second group are rarely operated upon there is no complete description of its pathology. Lamb[1] reported a case as follows: A colored woman, age thirty-six, two weeks after delivery entered the hospital with a temperature of 103°F. pulse 156, respiration 28; death twenty-four hours after admission. At autopsy the right lobe of the thyroid gland was apparently normal. The left lobe was very large, pale, soggy and infiltrated with fluid. The connective tissue extending down into the mediastinum was similarly infiltrated. A culture produced no bacterial growth.

DeQuervain[2] states: "there is hyperemia, fluidity, and disappearance of colloid. Foreign body giant cells are present with hypertrophy and desquamation of the epithelium; also leucocytic and round cell infiltration into vescicles and occasionally interstitial proliferation." After destruction of thyroid tissue fibrous atrophy may take place. Iodine content decreases which may lead to hypo- or hyper-activity of the gland.

Shields[3] reports a case in a girl, age ten months, of inflammation without suppuration lasting one week, followed by atrophy of the gland leaving the child a cretin with cessation of growth.

An enlarged gland is more susceptible to an inflammatory process. The disease indicates a bacterial origin although the offending organism cannot always be isolated. If the observer is aware that inflammation of this structure does occur, the clinical findings make the diagnosis relatively easy.

Acute lymphadenitis particularly in the region of the neck is a frequent complication of the contagious diseases, notably scarlet fever, measles and chicken pox. The superficial and deep glands or a combination of both may be involved. More often the inflammation results in abscess formation which requires incision and drainage. Infrequently the process subsides without suppuration. When the deep glands are involved the mobile structures of the neck may be displaced forward or to the right or left side often producing difficulty in breathing and swallowing. The diagnosis of deep cervical adenitis is made, but when the thyroid gland is involved, differential diagnosis becomes a problem. In this connection the following case is reported:

CASE REPORT

The patient, A. S. (No. 1883, Willard Parker Hospital), a male, age seventeen years, was admitted on March 27, 1940, with a chief complaint of hoarseness. His temperature was 102°F., pulse 108. Upon examination a punctate rash and bilateral acute catarrhal otitis media were noted, otherwise there was nothing significant. A diagnosis of scarlet fever was made.

The disease ran the usual course, the temperature becoming normal two weeks after admission. Four days later it rose to 100°F. becoming

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septic in type and at times rose to 105°F. At this time there was enlargement of the cervical lymph glands and a small mass was present in mass in the prevertebral region at the level of the 5th to 7th cervical vertebrae which is the cause of the compression of the trachea."

FIG. 1. A, anteroposterior view after swallowing thick barium, showing displacement of esophagus to the left. B, shows displacement of esophagus posteriorly.

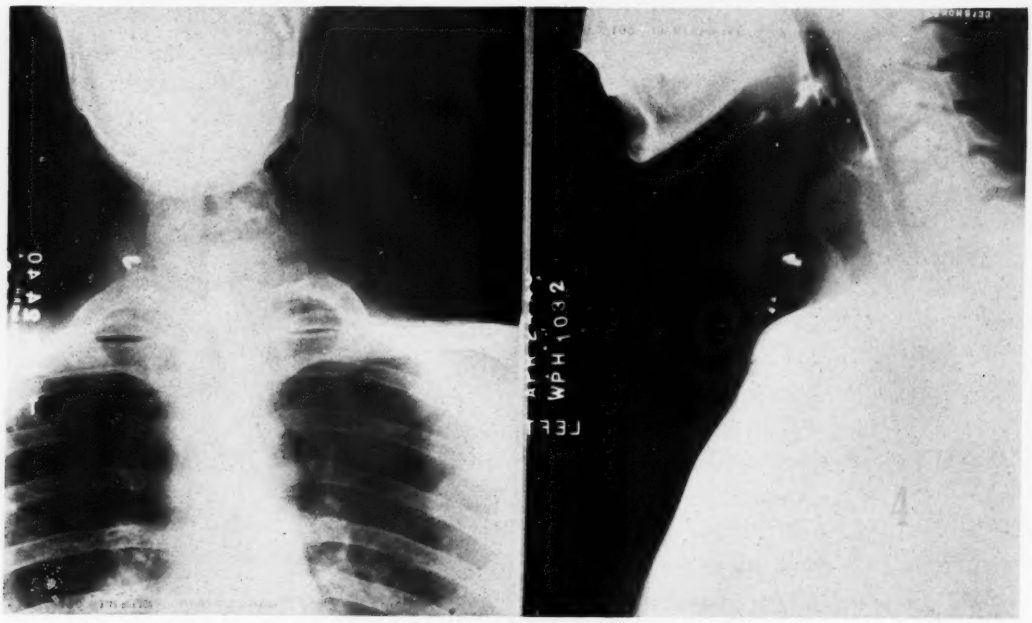

FIG. 2. *X*-ray taken five days later showing the normal position of esophagus, the mass in the neck having practically melted away.

the supraclavicular area to the right of the midline. Tenderness was present over this area. One observer considered this to be the thyroid gland. An *x*-ray taken showed "Marked compression of the trachea at the level of the 5th to 7th cervical segments. The compression is more marked from side to side than in the anteroposterior diameter. The estimated reduction in cross section is over 50%. There is a

The supraclavicular mass increased in size becoming quite prominent anteriorly, tender, firm, and the overlying skin slightly erythematous. A diagnosis of abscess of the deep cervical glands was made.

A laryngoscopic examination showed no abnormality but prompt incision and drainage was advised. After several consultations this was delayed and a second laryngoscopic

study was done. There was edema of the larynx, and a mass was described as present on the lateral aspect of the right posterior pharyngeal wall. In view of this finding prompt incision and drainage was carried out.

At operation on April 21st, a hocky-type incision was made extending upward along the mass and medially toward the midline. At this point several attempts at aspiration were made without recovery of pus. The platysma and pretracheal muscles were edematous and under tension. They were transsected. As this was done the right lobe of the thyroid gland, five to six times its normal size, bulged forward. There was marked edema of the capsule and the surrounding connective tissue. The vessels were dilated and the lobe a deep red. The isthmus and left lobe were not grossly involved. Thorough palpation revealed no other masses and the cervical vertebrae were normal. Further aspiration about and through the gland was done without recovery of exudate. The capsule was stripped off and except for the lobe's attachment to the thyroid arteries, it was completely mobilized. Unfortunately, no section was taken for study. The tissues were sutured in layers and a small rubber drain left *in situ*. No drainage followed. The postoperative diagnosis was acute thyroiditis.

The white blood cells averaged 20,000; polymorphonuclears 85 per cent; the basal metabolic rate was not taken pre-operatively; four days postoperatively it was minus 4 and fourteen days postoperative, plus 5.

Upon follow-up eighteen months later two small adenomatous nodules were palpable in the right lobe, otherwise the gland was normal. The basal metabolic rate was plus 6. The patient had no complaints.

The treatment in this type of case is usually conservative. When diagnosis is uncertain, and particularly with pressure and partial to complete obstruction of the trachea or esophagus, operation is necessary, and urgent. In the above case operation apparently hastened recovery. When there is abscess of the gland prompt incision and drainage is indicated.

SUMMARY

1. A brief review of nontuberculous inflammation of the thyroid gland is presented.

2. Inflammation falls into two general groups and the treatment in each is specific.

3. A case of thyroiditis simplex complicating scarlet fever is presented and the problem of diagnosis is discussed.

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UNDESCENDED INTRA-ABDOMINAL TESTICLE WITH TORSION OF THE CORD AND EMBRYONIC CELL CARCINOMA

CASE REPORT

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INTRA-ABDOMINAL testicle is in itself quite rare, yet it is an established clinical entity. In a survey of the available literature, we have discovered only eleven case reports of undescended intra-abdominal testicles revealing torsion of the cord, and only five of these were associated with tumefaction and malignancy. To further complicate the above, the case to be reported revealed a transposition of viscera.

The point of origin of the testes is the genital glands. Early in fetal development the genital glands are located far front in the abdominal cavity. From this point, they migrate backward, opposite the lumbar vertebra until about the eighth week, then they proceed further caudally and normally terminate their migration at the usual location in the adult. The genital gland is attached to the mesonephros, by the mesorchium in the male. The genital cords contain the mesonephric and Muellerian ducts and develop from a ridge on the lateral surface of the mesonephros. The mesonephros atrophies leaving a band of tissue which becomes continuous with the inguinal ligament, to be known as the gubernaculum testes. Due to the fixation of the gubernaculum testis and the rapid growth in the body length, there is a tendency for the testes to be pulled downward. This descent downward is further influenced during the third month by the development of the processus vaginalis, inguinal rings and inguinal canal. The testicle being enveloped with one layer of peritoneum from its origin, it is covered by another layer when passing from the abdominal cavity into the scrotum, the combined peritoneal coverings now being known as the tunica vaginalis propia. Two types of anomalies associated with the descent of the testicle are:

Undescended	Maldescended (Ectopic)
1. Abdominal—those retained	1. On anterior surface exterior oblique
2. Inguinal—those retained in canal	2. In Scarpas triangle
3. Pubic—those retained exterior to external ring	3. In perineum
4. Upper scrotal—those retained in upper scrotum	4. Transposed to opposite side

Torsion of the cord usually follows or is associated with stringent exercise or forceful straining, and the occurrence is usually ushered in with acute onset of pain on the respective side and occasionally with nausea. The pain and nausea usually diminishes with time, and complete cessation of pain follows onset of gangrene. Localized tenderness and rigidity in the lower quadrant is common at onset and must be differentiated from low bladder tenesmus, ureteral colic, acute appendicitis, etc.

CASE REPORT

W. R., Case No. 1145, a young male, thirty-one years of age, white, was referred to my service by Dr. Grady Siske. He was complaining of acute pain in the lower right quadrant, occurring simultaneous with a normal bowel evacuation, and becoming progressively more severe for one hour before admission. The patient was nauseated and vomited two or three times. The pain was localized definitely in the right lower quadrant and he complained

greatly on the slightest pressure over McBurney's point. There were no pathological urinary symptoms, signs or laboratory findings, and no history of similar attacks prior to this date. His temperature was 99°F., pulse 108 and respiration 22.

A long McBurney incision was made, and it revealed a transposition of the cecum to the left side and a hard mass on the floor of the pelvis, which was freely movable and attached to the edematous and twisted cord. The cord was ligated at the point of attachment and the cord and testicle resected. Further examination exposed the normal appendix (which was removed) lying along the left side of the pelvic brim and extending up to the transposed cecum.

Grossly, the encapsulated testicular mass was about the size of an egg. The outer surface was smooth with the exception of a few small nodular elevations at one pole. The cord was twisted, edematous and about 2½ cm. in width at the maximum point of swelling below the torsion.

The microscopic report of Dr. H. C. Lennon is as follows:

Microscopic section revealed a cellular tumor growth, the cells being fairly uniform in shape and size throughout. In some places it appeared as if the cells were making abortive attempts to form acini. Occasional mitotic figures were scattered about. There was no recognizable testicular tissue in this section. There was rather extensive infiltration throughout the greater part of small round cells, along with a few areas showing actual necrosis. *Diagnosis:* Embryonal cell carcinoma in an undescended testicle.

The patient has apparently effected a complete recovery, with no evidence to date of metastasis or complications of any kind.

In conclusion, the rarity and unique pathological condition revealed in this case was most interesting and quite gratifying in that the early finding and removal of this malignant tumor, as the result of a coincidental torsion of the cord, may mean a long and happy life for this fortunate patient.

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Selected Book Reviews

IN comparison with the lush days, medical publishers are not to be blamed or criticized if their lists become thinner month by month during these government controlled, war days. However, a few "more than good" works from the press are at hand for our inspection and reading. This month we have space to tell our readers about only a few of the latest outstanding works.

"Blood Substitutes and Blood Transfusion,"[1] edited by Stuart Mudd and William Thalhimer with seventy collaborating investigators (all recognized outstanding physicians) presents an up-to-the-minute description of the best current practice of this important war-time procedure. One learns of procurement, administration, storage and transportation, the newer blood substitutes and technic. With the American Red Cross all over the country getting blood from volunteer donors—a great chapter in American history—it would be well for the thousands of doctors of medicine in the armed forces to read this book carefully. Just after writing up to this point, a Commander in the medical department of the U. S. Navy dropped in on us, saw the volume, and said, "Just what I've been looking for and need." So we gave it to him. A hint to the publisher: Why not sell a raft of them to the government. The result may be that thousands of boys in this war may have their lives saved.

Then there is "Religion and Health" by Seward Hiltner[2] if you go in for this line.

Charles C. Thomas has brought out "The Hemorrhagic Diseases and the Physiology of Hemostasis" by Armand J. Quick.[3] This timely monograph presents the fundamental factors of the coagulation of the blood, present day clinical knowledge, diagnosis, treatment and a study of this important subject.

[1] Blood Substitutes and Blood Transfusion. Edited by Stuart Mudd and William Thalhimer. Springfield, Ill., 1942. Charles C. Thomas. Price $5.00.

[2] Religion and Health. By Seward Hiltner. New York, 1943. Macmillan. Price $2.50.

[3] The Hemorrhagic Diseases and the Physiology of Hemostasis. By Armand J. Quick. Springfield, Ill., 1942. Charles C. Thomas. Price $5.00.

An interesting book, by Albert Q. Maisel,[4] concerning the story of the new medical weapons that are and will save lives, is called "Miracles of Military Medicine." This offers a good evening's reading.

The Year Book Publishers give us the second edition of "Sulfanilamide and Related Compounds in General Practice" by Wesley W. Spink.[5] Inasmuch as the majority of men prescribe these drugs for every ailment from falling hair to fallen arches, it might not be out of order to suggest more knowledge on this subject, hence this book.

If the anesthetists in this country were as numerous as general surgeons, we would make a major issue of John S. Lundy's "Clinical Anesthesia," with 266 illustrations.[6] Again, the government might invest in a few hundred (or should we say thousand) copies and distribute them among the lads who "sling" anesthetics in the army, navy, marines, coast guard, flying forces, et al. This is an excellent and important book.

Macmillan offers us Maurice Levine's "Psychotherapy in Medical Practice," a non-technical handbook[7] intended for the general practitioner and medical student. This book is interesting and instructive.

"Human Embryology" (one of the Medical Student Series) by Joseph Krafka, Jr.,[8] was written to meet the demand for a short, concise, complete textbook of embryology. If you are interested, we recommend it.

Medical students, advanced Red Cross workers, and many others who have taken the usual first aid courses are recommended to follow it up with Cole and Puestow's "First Aid . . . An Advanced Guide." We mention this excellent book[9] so that physicians will know

[4] Miracles of Military Medicine. By Albert Q. Maisel. New York, Duell, Sloan and Pearce.

[5] Sulfanilamide and Related Compounds in General Practice. By Wesley W. Spink. 2nd ed. Chicago, Year Book Publishers. Price $3.00.

[6] Clinical Anesthesia—A Manual of Clinical Anesthesiology. By John S. Lundy. Philadelphia, 1942. W. B. Saunders. Price $9.00.

[7] Psychotherapy in Medical Practice. By Maurice Levine. New York, Macmillan.

[8] Human Embryology. By Joseph Krafka, Jr. New York, 1942. Paul B. Hoeber, Inc. Price $4.75.

[9] First Aid—Surgical and Medical. By Warren H. Cole and Charles B. Puestow. New York, 1942. D. Appleton-Century.

what to recommend when a patient asks, "Doctor, what is the best advanced first aid book? I've finished the beginner's course in first aid and I want to go on from there."

The Oxford University Press[10] gives us the Oxford Medical Outline Series . . . Public Health and Preventive Medicine . . . Gastro-Intestinal Diseases . . . Urology . . . Gynecologic Surgery. They are just what they claim to be—outlines of the subject. If you are a recognized specialist, you will not be interested; all others will find them valuable reading.

And we have the fourth edition of "Fractures" by Paul B. Magnuson.[11] It is well illustrated and has won its proper place by being among the best. Again, this is a book the government might with profit distribute among the army and navy medical personnel.

Probably most men in the medical corps of our armed forces, especially those en route to the tropics, are familiar with "Medical Parasitology" by James T. Culbertson.[12] Malaria and sleeping sickness (to mention only two common diseases) infect a large part of the world's population. Now, they threaten many Americans in the armed forces. This volume describes the parasitic animals which have medical importance and points out the various manners by which they establish themselves upon human beings. We learn etiology and the accepted methods of diagnosis, together with procedures which have proved effective for eliminating the parasites from persons already infected. This book fills a great need and we recommend it most highly.

[10] Oxford Medical Outline Series. Published by Oxford University Press, New York.

[11] Fractures. By Paul B. Magnuson. Philadelphia, 1942. Lippincott. Price $5.50.

[12] Medical Parasitology. By James T. Culbertson. New York, 1942. Columbia University Press. Price $4.25.

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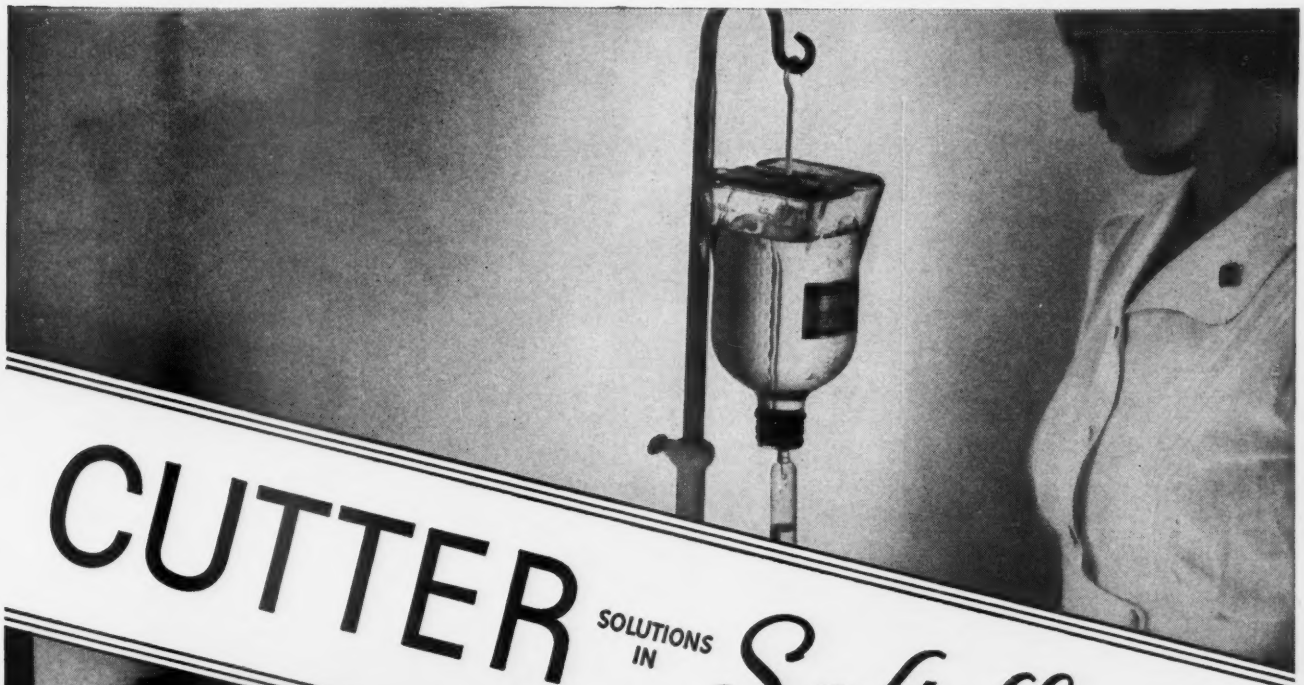

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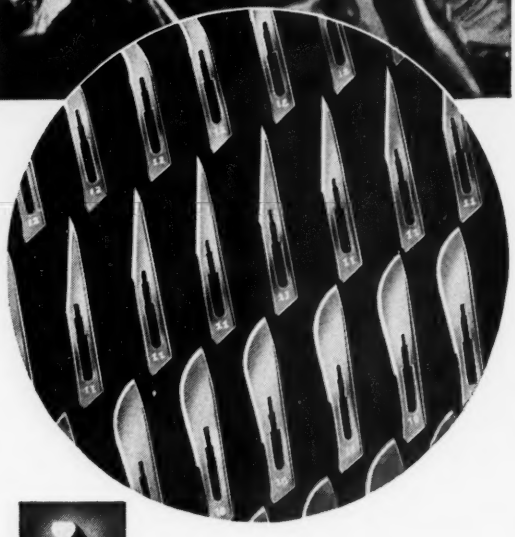

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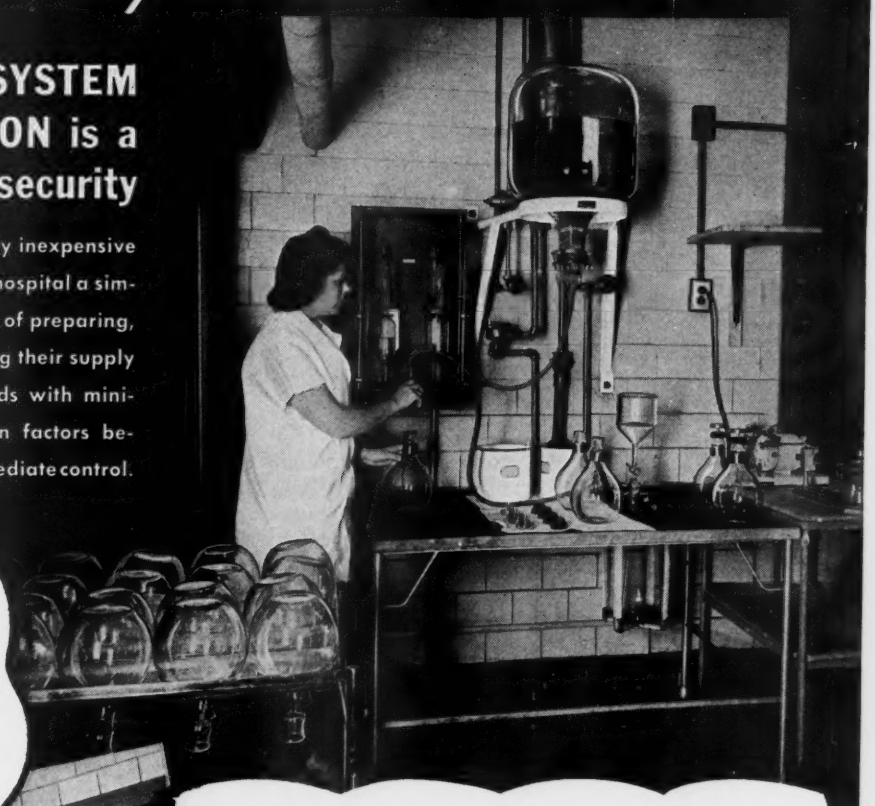

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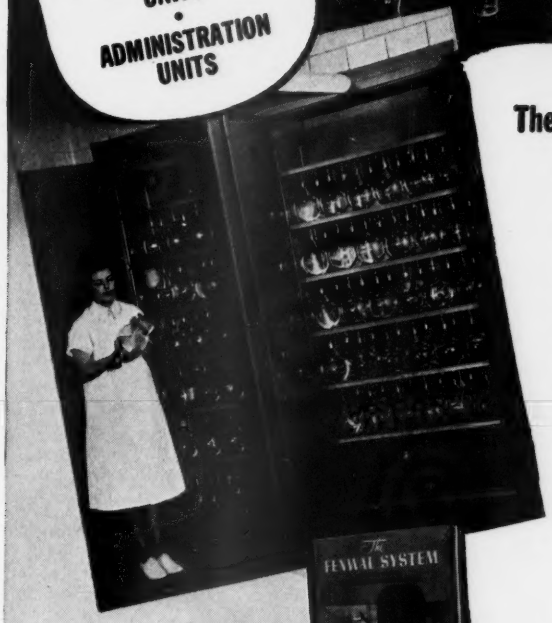

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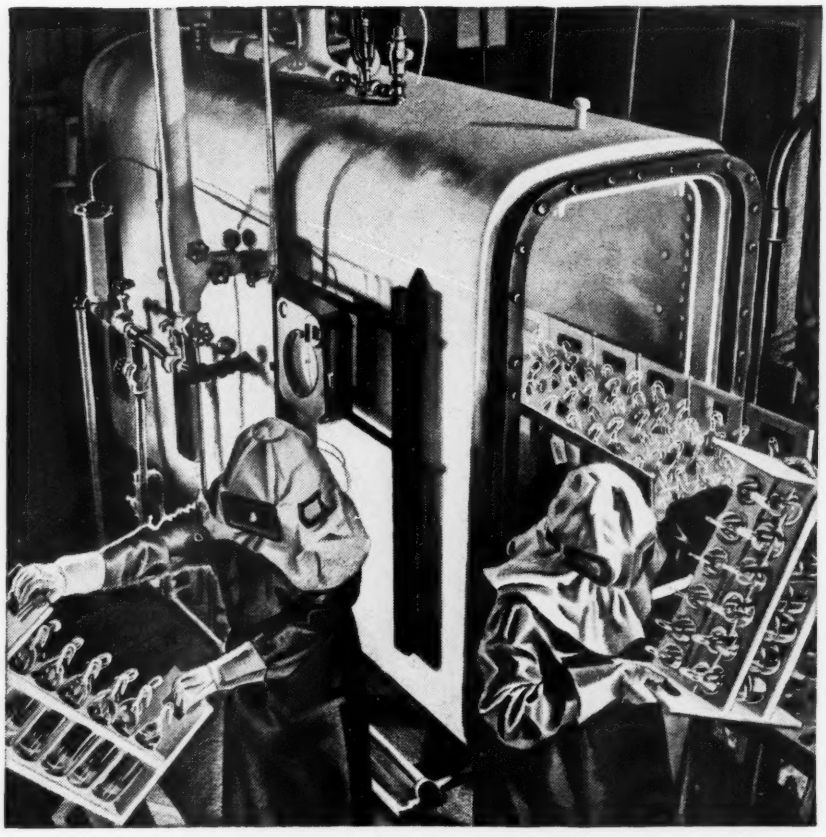

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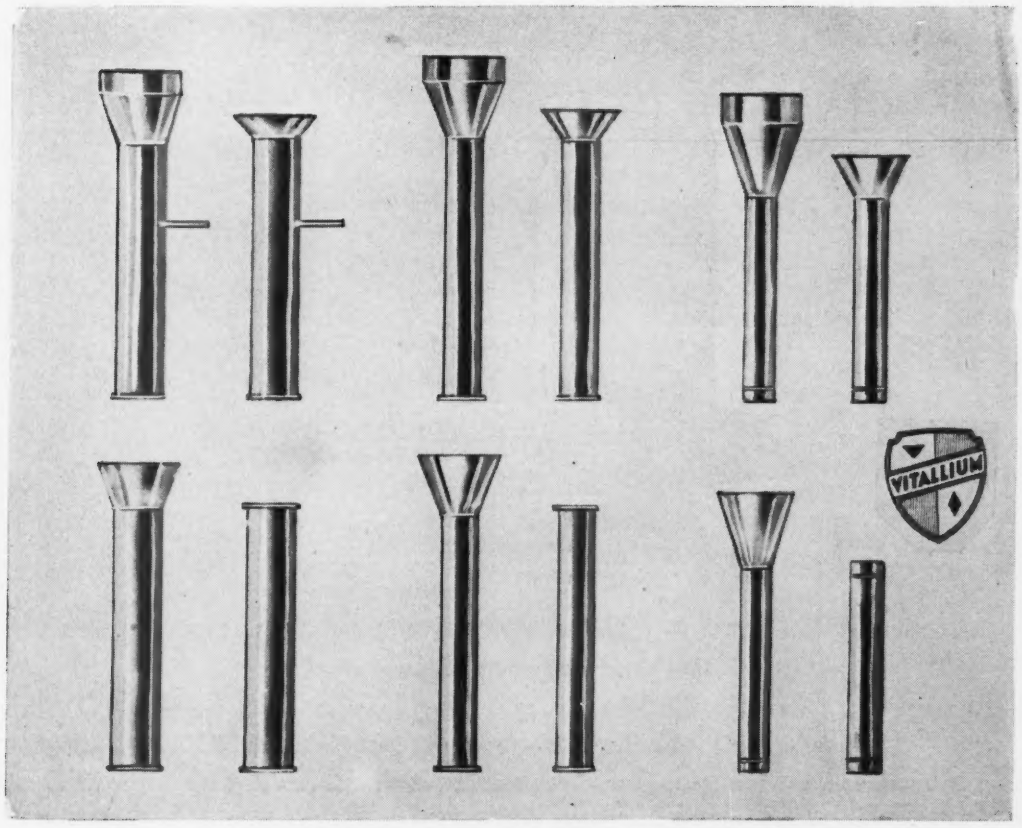

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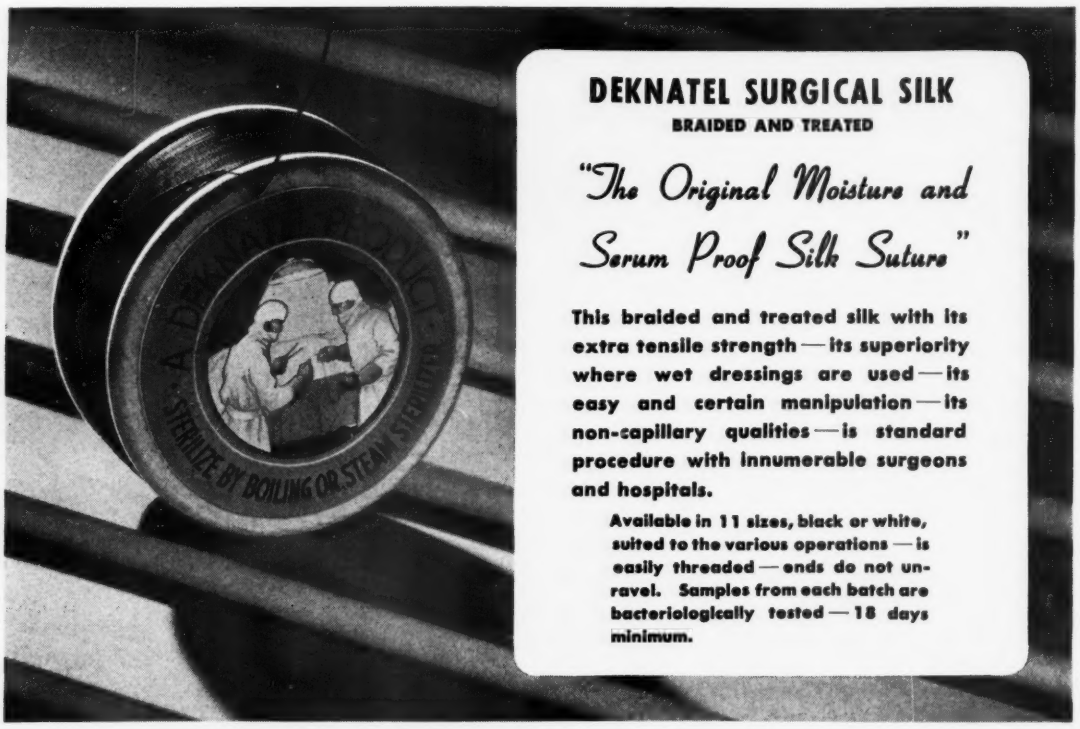

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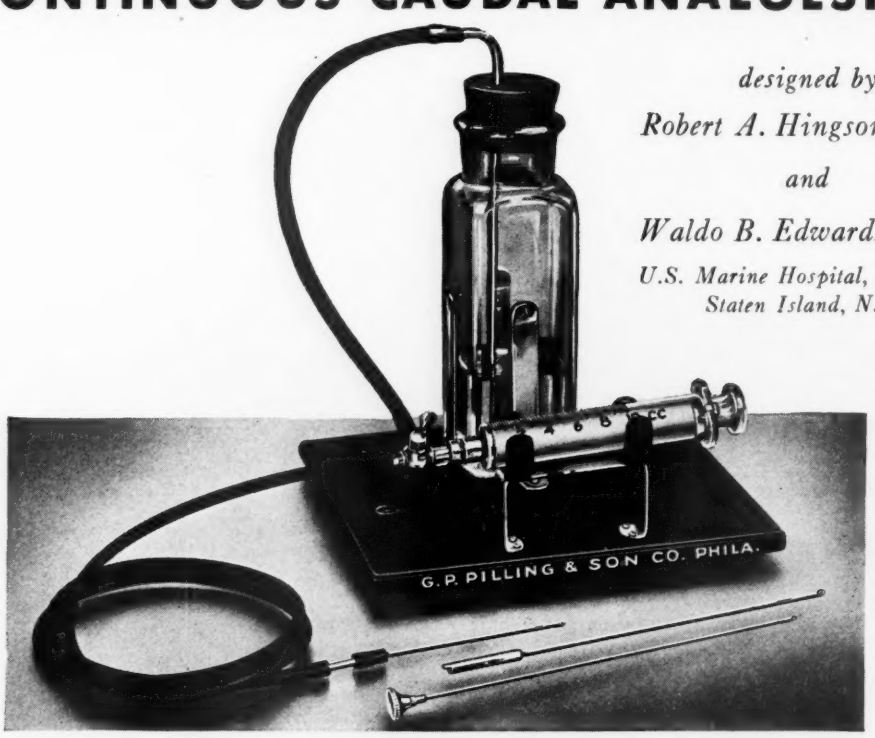

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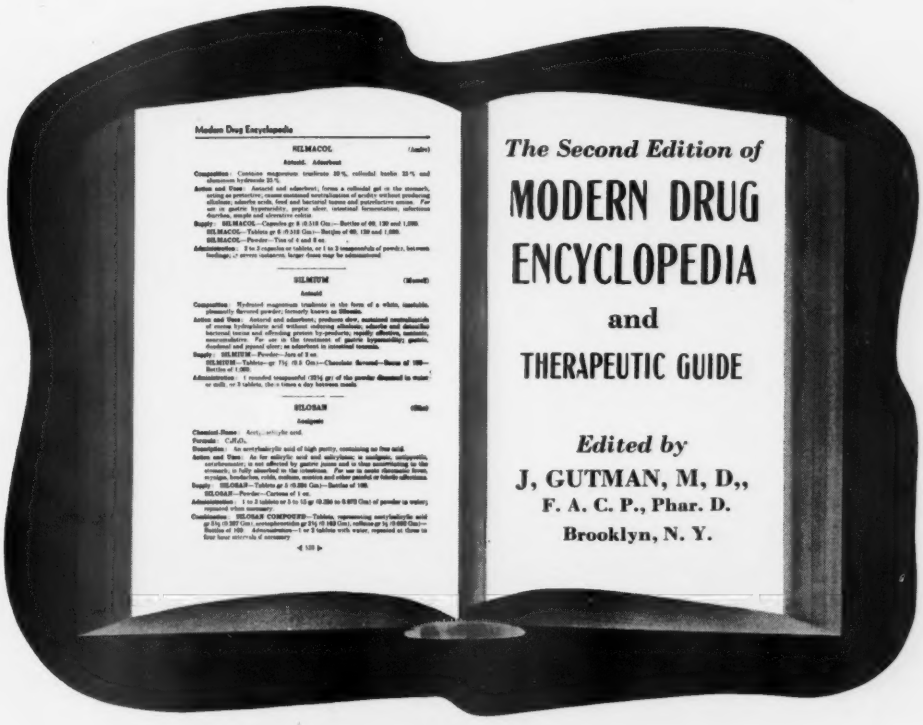

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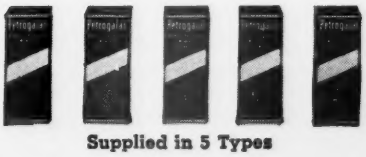

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